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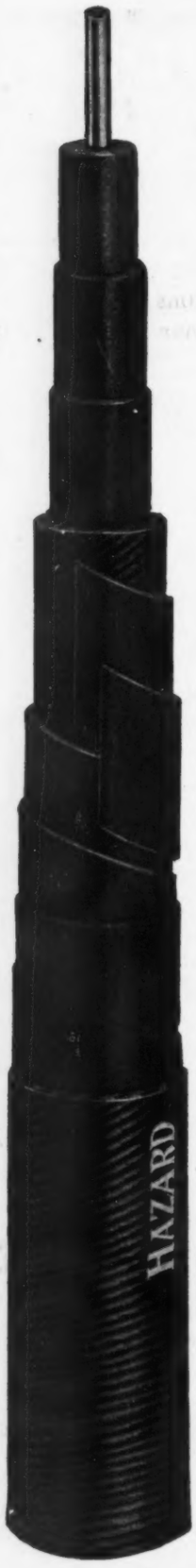

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The American Dollar in England

FOR many years English capital has reaped rich rewards from its investments in American railroads and utilities. But times have changed and the American dollar now invades the sacred precincts of London to buy the Greater London & Counties Trust, Ltd., a large utility group serving various districts, chiefly in southern England. This news stirred London financial and political circles, and several financiers even questioned the propriety of the Earl of Birkenhead and Sir Philip Dawson serving as executives of the American-controlled properties.

Some of this reaction in England can be understood, but our own experience with foreign capital in the past and even today does not give evidence that anything deleterious to the English can happen. On the contrary, a great impetus to the electrical development of England would seem probable. American ideas of bulk production, improved and extended service and aggressive sales efforts should bring the English utilities some very valuable aids that will give customers cheaper and better service. In addition, the American conception of interconnection and of national instead of local development should permit a rapid growth of the British national electricity schemes unhampered by local traditions.

There need be little fear of the result of American control of foreign utilities in so far as service to the public is concerned. The fundamental conception of American executives is that good business comes only as a result of good service. Recognition of this fact is evident in the remark of Sir Philip Dawson: "I would not have touched the trust unless I had known that it was for the benefit of Britain." In the foreign utility field American dollars are certain to be service dollars.

* * * *

What the Edison Museum Is Meant to Do

BECAUSE of his sincere admiration for the man, to a degree approaching hero worship, Henry Ford is buying as fast as he can every discoverable and authentic piece of building apparatus and machinery, as well as tools, furniture, clothing and other articles used by Edison at Menlo Park and Fort Myers and housing them in the original buildings reconstructed at Dearborn, Mich., or in the new museum erected there for the purpose. So minutely is the task being performed that even the earth that covered the site at Menlo Park, together with the Jordan boarding house, has been transferred to Dearborn. Of course, the Ford museum of Americana embraces other exhibits than Edisonia; but the inspiration of the museum has come from Mr. Edison and his unparalleled life of achievement.

The chief purpose in the museum is not, however, to exhibit objects of historical interest, but to use them in such a way as shall inspire students with the same zeal and sincerity which inspired Mr. Edison's researches. That is to say, while the museum will be filled with objects of educational and historical value, it will be an operative exhibit and a large technical school as well. The sum of $5,000,000 has already been allotted for the physical plant of the museum, and Mr. Ford is prepared to make provision for the perpetuation of the institution and its work. Mr. Ford's own industries will provide three thousand students for the establishment, the facilities of which will be open to technical students everywhere. It is Mr. Ford's hope that his Dearborn institution will be the means of arousing mental energy in young men and stimulating them to attempt serious creative work on their own initiative, and toward that consummation the electrical industry wishes him every success. Of the unique character of Henry Ford's industrial genius and the genuine public spirit that pervades it illustration is again given in the plans that he is pushing to completion.

* * * *

Lightning Research on Transmission Lines

A REMARKABLE series of researches and scientific papers treating of disturbances on electric transmission lines caused by lightning, culminating in the papers offered at the recent winter convention of the American Institute of Electrical Engineers, have at last made it possible to anticipate with a fair degree of clearness the actual picture of what happens when thunderstorms occur in the neighborhood of a transmission line. The flashing of electricity between cloud and cloud and between cloud and ground, which may be positive or negative, causes free charges of high potential to appear at local points on a transmission line. These charges often exceed the power of resistance of insulators. The use of ground wires mitigates the severity of the disturbance materially but unfortunately cannot be relied upon to eliminate flashovers entirely.

As long as a surge in a transmission line due to lightning has an abrupt front and a sufficiently abrupt tail or falling portion, the insulators have the benefit of a high impulse ratio, as shown by many reports of transmission lines. This ratio may be as high as two and considerably over. Should it appear, however, that there are some surges in transmission lines induced by lightning of which the tail portion is sustained for, say, some hundredths of a microsecond, it would follow that the insulation strength of the insulators would not have the benefit of anything like the same impulse ratio, and they might in extreme cases have little more than the 60-cycle flashover value. Since it is the nature of the bound charge in a transmission

line which is freed by the lightning flash to maintain a steady potential on the wire until the charge begins to leak away, it remains for further investigation to show how many cases, if any, there may be where this charge is not dissipated with sufficient rapidity to reach the impulse ratio of two.

It is very interesting to note that, if the action is as here indicated, the rising part of the crest of the surge in the transmission line will be due to the form of the lightning discharge, but that the slope of the falling part will be due, not to the conditions of the lightning discharge, but to the distribution of the charge on the line and the line characteristics. This latest picture is not unlike the conceptions that have been tentatively assumed for the action of lightning in the past, but it now has the basis of strong probability. Unfortunately, the situation leaves transmission lines still subject to flashovers in the more exposed districts—much reduced surely, but still troublesome—as is conclusively shown by the carefully prepared data collected by Philip Sporn and the sub-committee of the power transmission and distribution committee of the A.I.E.E.

Does this situation not indicate the wisdom of abandoning the hope of a line with 100 per cent reliability in favor of the provision of alternative circuits almost instantaneously cleared without loss of load in case of trouble? The problem then becomes more particularly a relay problem and, as such, one involving much less expensive and clumsy expedients than the effort to make a transmission line proof against flashover. The same amount of effort spent on relays and circuit-breaker control might well offer much greater returns in the future than efforts to obtain line insulation proof against flashovers.

Considering the research work done in these lightning studies, it is difficult to exaggerate the ingenuity and resourcefulness of the investigators. The effectiveness and originality of the methods used and apparatus devised are not less than astonishing. The arrested-discharge method of studying the mechanism of spark breakdown is most far-reaching and illuminating. The ability to carry the discharge up to any desired point in its development and there stop it and photograph the result is a most powerful method of analysis. The attainment of the seemingly impossible is shown in the photograph of the wave form of a lightning surge, occurring at some unexpected moment and lasting but a few microseconds. This is the final picture of evidence necessary to complete the picture of the lightning surge on a transmission line.

The efforts that have been made and must still be made to clear this situation satisfactorily are enormous, and those supplying the means to do so have put the electrical industry under great obligations. The work has necessarily fallen only on those who have the necessary knowledge, training and equipment to accomplish it. Since the direct benefit from the improvement of lightning protection as it appears to be working out will accrue largely to the operating companies, it would seem that while the actual studies have no doubt been made by those best qualified, at least a considerable portion of the expense involved could very properly be borne by the former.

Is it not worth while to suggest at this time that more complete and conclusive results could be obtained in these studies, and much effort, time and expense saved, if the field work which is now being carried on by two great organizations could be co-ordinated, with full co-operation from the electrical power industry? In this way the work could be carried out for the same outlay on a much broader scale, and a much more comprehensive program would be possible. In addition, the necessity of duplicating many measurements at many points would be avoided, thus freeing existing instruments and apparatus to procure additional data. There would be the further advantage of using a single type of device for measuring a given quantity, such as maximum surge voltage, keeping all readings strictly comparable. Would not such co-operation form a long step toward getting a virtually complete simultaneous picture of the lightning attack in some of the more important operating transmission lines with their terminal apparatus? Such a result would be a triumph of practical scientific study. It would be of the very greatest importance to the electrical industry.

* * * *

Safeguarding Intercompany Ties

TO PRESERVE continuity of service in case of emergency, intercompany ties must be adequate for the supply of the full curtailed or interrupted load within fixed limits of frequency and voltage drop, assuming that reserve capacity is exhausted in the local areas affected. Therefore in planning interconnection budgets each management must decide whether the cost of an interconnection capable of meeting a particular forecast emergency is warranted and decide what is economical to spend. It may or may not be profitable to enter into an interconnection arrangement under which Company B can take over all of Company A's load at any moment of the twenty-four-hour cycle and *vice versa*. But whatever the capacity of the tie-in, it is most essential to safeguard its immediate and satisfactory performance under the operating conditions set forth in the contract.

Experience with interconnection indicates that on the whole participating companies can obtain about the degree of protection against interrupted local service for which they are willing to pay. This does not mean that transmission-line performance and station operation can be insured against any discontinuity of service whatever, but that a very high percentage of continuity can be had if the participants are prepared to make the necessary investment in plant and operating skill. To attain a high degree of reliability a careful study must be given to every phase of procedure in case of failure of lines and equipment on either side of the tie point, and the cost of the degree of insurance sought must be made clear to those who pass upon the budget items recommended.

When properly handled such an analysis will penetrate far into the system of each company. It will involve not only the balancing of the number of circuits in the tie-in line against their total annual cost, but consideration of the results of transformer and circuit-breaker failures which occur when sudden demands are made upon one system to take over load dropped by another and a clear visualization of the series of events caused by non-functioning of links in the interconnection chain. The speed with which transformer taps can be changed to facilitate intercompany transfers of energy in case of equipment failure is an important factor in many instances. Accessibility of taps and switches, the effectiveness of the communication system, the extent of cut-back required on a network to segregate sections of line and transformer banks for emergency-load allocation, the relation of boiler capacity to the loading of turbo-units in case of trouble in the fire room, and even the require-

ments of auxiliary steam-plant apparatus under abnormal situations—these are a few of the elements of safeguarding interconnections still deserving investigation by the operating engineers and system designers and the sympathetic and monetary support of executives.

* * * *

Improvement Program for Appliances

ALL electrical men wish to give the best electric service at lowest cost to their customers and are working to this end. In the appliance field, as in others, studies are under way to bring about improvement in quality and performance. Recently an appliance committee has been organized under the auspices of the Association of Edison Illuminating Companies, and an announcement has been made that this committee will work with the Electrical Testing Laboratories in the conduct of this work.

Surveys will be made of the quality and performance characteristics of electrical equipment, and the second step will be the constructive application of the facts revealed. Ultimately it is expected that it may be possible to grade brands as to qualities and performance, but no approval, label service or specifications are contemplated at present or before facts are available. The full co-operation of the industry is to be solicited in the development of the work.

For some time there has been a need for survey work with appliances. As pointed out editorially in the past, facts as to qualities and performances of appliances are needed, and in addition performance characteristics can well be studied to develop the sales and service facts needed to give the salesmen and the users of appliances full information as to the service elements of the appliance. The new committee has started a worth-while work. It is logical in restricting its present activity to a tangible search for data. Later developments can take the form of the application of these facts to the best interests of the industry and the customers.

* * * *

Value of Precipitation Forecasts

POWER companies which are largely dependent on hydro-electric generation have long recognized the need of some accurate way of forecasting precipitation. This is indicated by reports of the N.E.L.A. hydraulic power committee and by the studies by individual companies—notably those in the Southeast, in Pennsylvania and on the Pacific Coast. Recently interest has been awakened in the possibility of using records of annual tree growth as a measure of past precipitation to establish some relationships that can be used to forecast the future. The Carnegie Institute has measured the spacing of the annular rings in about six thousand trees, including some more than four thousand years old.

By plotting a curve of annual growth as measured by the width of the rings and comparing this with actual government rainfall records, it has been found that rainfall throughout civilization has been of a cyclic character. It is not possible to calculate yearly rainfall because tree growth is an integration of precipitation. It may lag several seasons behind variations in moisture. However, it is possible to calculate and plot major cycles superimposed upon which are cycles of shorter duration, which in turn have harmonics.

This study has been taken up recently by California utility companies to aid them in formulating their future hydro construction and operation with greater assurance. In the California studies two observations of particular interest stand out. According to reports it has been established that the relationship between ocean temperatures off the coast of Japan and the temperature at Reno, Nev., has a definite bearing upon precipitation on the west slope of the Sierra Nevada Mountains. This information will provide a further check on tree records and will serve as a means of short-range forecasting. The technique of measuring tree rings has been greatly improved by a unique microscopic micrometer which eliminates visual errors inherent in former methods.

Tangible results will soon be available which should prove of inestimable value to power companies. For instance, when a new hydro-electric project is being considered the rainfall trend curve will indicate whether it is desirable to provide large storage at first or whether the investment in storage works can safely be deferred for a period of years. It will also be possible to anticipate periods of unusually low precipitation, such as occurred in California during the power shortage a few years ago, and provide against these by greater storage or steam reserve.

Tree records of rainfall are not particularly accurate in the interior sections of the country, but they should prove of great value to those regions that are dependent upon ocean moisture for their precipitation.

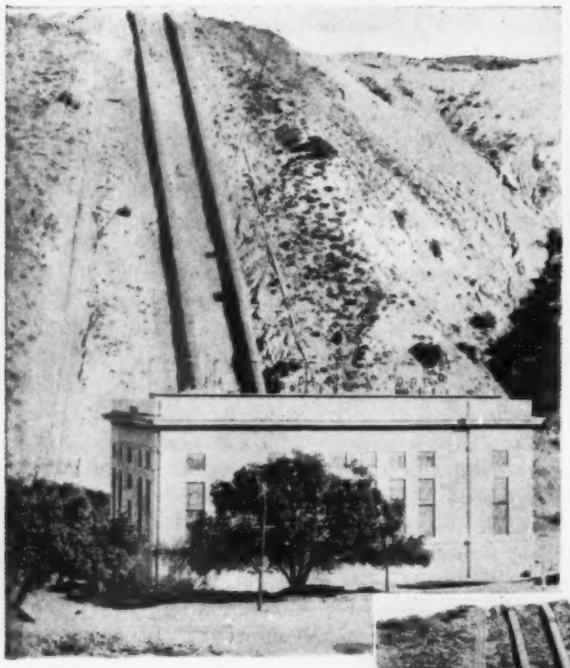
* * * *

Processing Fuel Possibilities

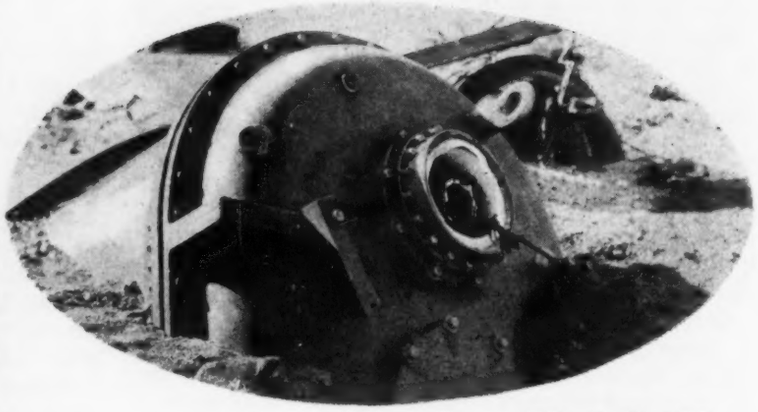
A VERY rapid experimental development of fuel processing has come about in recent years amid the shifts and changes in economic progress. Granted that several processes are complete and that chemical knowledge is adequate to refine and manufacture all byproducts, there remains to be developed the industry economic policy that will make the most of fuel processing.

Some consideration has been given to the embarkation of light and power or gas companies into the fuel-processing and chemical-refining business, but there are evident handicaps to this kind of development. Each of these industries is unskilled in the conduct of a chemical business and each has enough to do to develop the service business for which it is organized. Logical progress in fuel processing calls for a unit industry wherein the coal is a raw material, gas and fuel are by-products and chemicals or chemical compounds are the chief products of a national chemical company. A study of conditions in this country shows that the economic standing of fuel processing depends very largely upon producing lacquers, insulation material, oils, dyes and other refined chemical products and that gas and fuel should be cheap and voluminous byproducts of a big chemical enterprise.

It will take time to develop the business situation in coal processing, but a corporate enterprise with manufacturing plants in each market area might well develop a very profitable chemical business and at the same time produce processed fuel and gas that existing utilities could utilize to reduce their costs of production. Present fuel prices and operating conditions appear to prohibit an extensive development of coal processing as a by-product enterprise of electric and gas utilities, and this day of big business witnesses the development of national industries overnight. If the economic situation is sound, coal processing may be counted upon to give a new major industry to this country.



San Francisquito power house No. 2 before being demolished by a 125 ft. wall of water

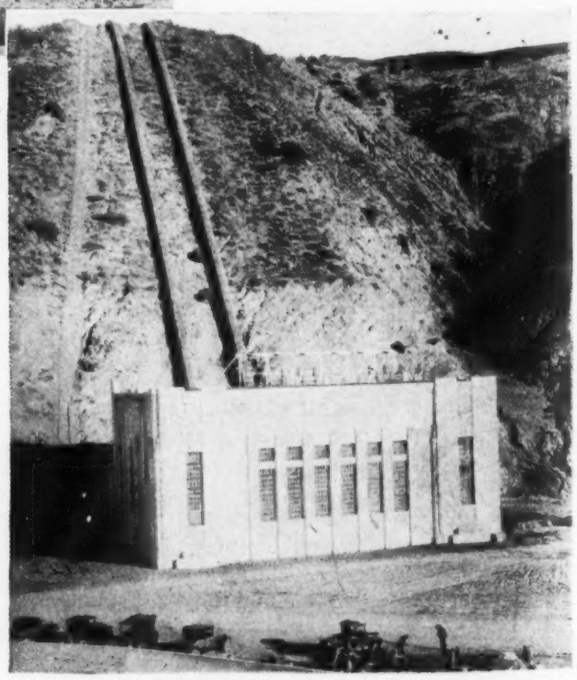


One of the transformers as left by the flood

San Francisquito No. 2 Back in Service

Remains of power plant after the flood

Reconstructed plant

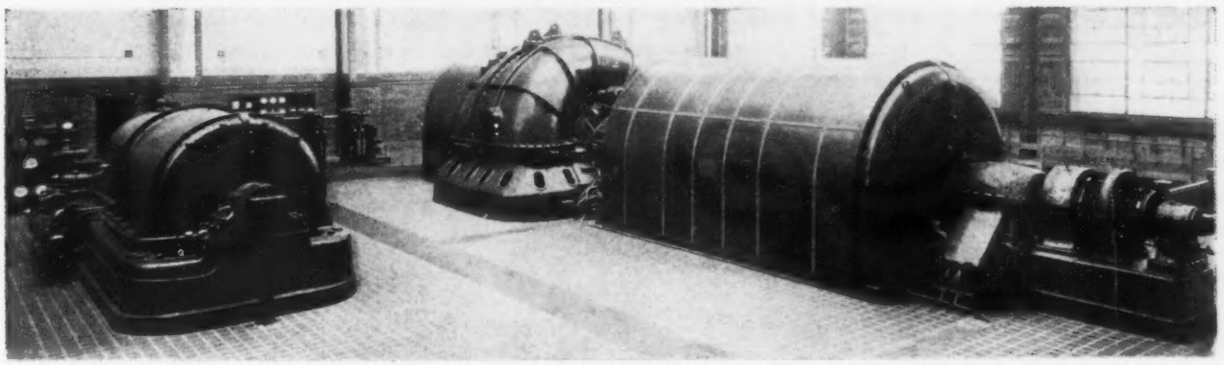


COMPLETE rebuilding of San Francisquito power plant No. 2 following failure of St. Francis Dam on March 13, 1928, was accomplished by the Bureau of Power and Light of Los Angeles in the remarkably short period of seven months and eighteen days. One 17,500-kva. generator and seven 4,667-kva. transformers were salvaged from the wreck, the generator going into service on June 14. The second machine had to be largely rebuilt and required a longer time. The "slip-form" method of pouring concrete was used in reconstructing the power house building and every facility to expedite rehabilitation of the plant was brought to bear.

60,000-Kw. Turbo-Generator

for Lakeside

One unit of this rating found more economical than two 30,000-kw. machines. New unit can heat maximum condensate flow to 360 deg. Machine tested at full load and actual water weighed



The second 1,200-lb. and the new 300-lb., 60,000-kw. units at Lakeside station

GROWTH of the electrical system load in and around Milwaukee required the installation of additional generating capacity in 1928. The load increases indicated that it would be necessary to install either two 30,000-kw. units, one in 1928 and one in 1929, or one 60,000-kw. unit in 1928. Economic considerations, from both the investment and coal consumption standpoints, showed the 60,000-kw. single-cylinder machine to be the best. Under competitive bidding, the order for the turbine was placed with the Westinghouse Electric & Manufacturing Company and that for the condenser and extraction heaters with the Foster Wheeler Company.

The turbine proper has two impulse wheels and 22 reaction wheels. It is the first single-cylinder, single-flow machine of this size built by Westinghouse, and several design features, such as anchorage of the latter blades, axial expansion and turning gear, were new developments. The unit has an exceptionally clean external appearance, due to removal of governor gear and exposed oil piping at the front end. The turbine governor is of the impeller type, actuating the steam valves by oil pressure.

The three steam valves are removed from the turbine foundation. The annular ring supplying steam to the first stage impulse nozzles is divided into two parts, the primary and secondary valves each supplying one part. The tertiary valve feeds a point after the two impulse wheels and before the first reaction wheel. With one valve open a steam flow of 340,000 lb. per hour results, with a non-extracting load of 37,250 kw. or an extracting load of 33,400 kw. With two valves open and a throttle flow of 476,000 lb. per hour a non-extracting output of 51,400 kw. and an extracting one of 45,600 kw. are obtained. The third valve is then opened to carry further increases in load up to full capacity.

The turbine has four extraction points. The first two heaters raise the condensate temperature to about 200 deg., at which it may be used in the open heaters of the 300-lb. boiler feed system. The last two heaters heat the water to 330 or 360 deg. (depending on turbine load) for feeding to the 1,300-lb. boilers. The machine is capable of heating its maximum condensate flow, 660,000 lb. per hour, to 360 deg. for 1,300 lb. boiler feed.

Due to the variety of conditions under which the turbine can be operated, it has many values of heat consumption. It may be operated straight condensing, or with two heaters, or with four heaters. The load may be such as to require one, two or three steam valves opened. The last two heaters (which heat the 1,300 lb. boiler feed) may heat sufficient feed water for one or two high-pressure boilers or the entire condensate flow. The turbine heat consumption was guaranteed on two-heater operation with two steam valves open.

Test Work Simplified

Acceptance tests were run on this 60,000-kw. machine by actually weighing the water used. Two tanks of 85,000 lb. capacity each are set on Fairbanks beam registering scales. One tank will take the full load throttle flow of 666,000 lb. per hour for 7½ minutes. Provision is made for one-man operation of these huge weighing tanks. Contrasted with this, the previous weighing tanks were of 5,000 lb. capacity each and required at least three men for satisfactory operation.

Tests were run at eight different loads. The heat consumption at the guaranteed figure was 1.5 per cent below the guarantee, so the machine surpassed expectations.

The unit is provided with a 15-hp. induction motor which can drive the rotor at 25 r.p.m. through a belt and spiral gears. When the machine is coming off the line and coasting down to a stop the turning gear will engage

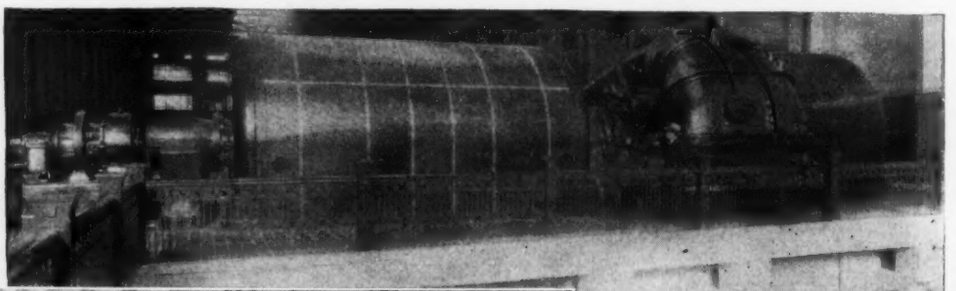
and roll the shaft. This permits equal cooling of the spindle. The turning gear will not start the spindle from cold, so a hydraulic jack is provided to give the rotor a fraction of a turn when desired.

The generator is a three-phase, 60-cycle, 1,800-r.p.m. machine, operating at 13,800 volts and 85 per cent power factor. A closed type surface air cooler serves the generator, the heat being absorbed by the turbine condensate. Both ends of the phase windings of the main generator are brought out to a terminal board.

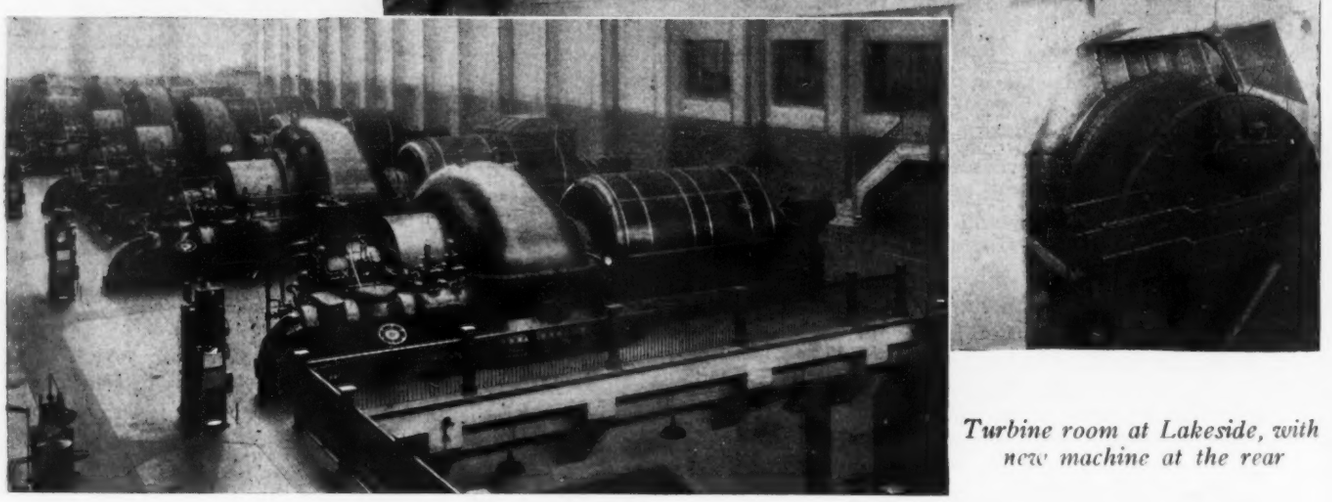
A 175-kw., 250-volt exciter is direct connected to the end of the generator shaft. It is so designed that at some future time it may be used with a voltage regulator and positive phase sequence network to give quick-response excitation. The essential and exclusive feature is the connection of the field poles in a number of parallel paths, each with resistance in circuit, so that the ratio of inductance to resistance is low. This results in a very rapid response to change in excitation. At present the exciter operates in parallel with other shunt-wound exciters in the station, though this need not be the final arrangement used if the planned design is followed.

The condenser is single-pass, with 55,000 sq.ft. of surface. The tubes are rolled into both tube sheets, one of which is fixed and the other floating. Doing away with packed tubes is expected to reduce circulating water leakage into the condensate. An integral air cooler is provided and air removal is effected by two three-element steam jet air pumps.

At the same time that this 300-lb., 60,000-kw. machine was installed a second 1,200-lb., 7,700-kw. turbo-generator was also put in. It will alternate in operation with the first 1,200-lb. unit. This summer, when the second 1,300-lb. boiler is installed, both 1,200-lb. turbines will feed the 300-lb., 60,000-kw. machine, and thus permit a large part of the station generation to be made by the economical high-pressure section.



60,000-kw. unit with condenser and generator air cooler



Turbine room at Lakeside, with new machine at the rear

Reliability of Apparatus Proved by Flood

WHEN a power house can be completely washed away and leave generators standing on their foundations and large transformers can be washed downstream from 100 to 300 yd. and buried in débris and all but one of the two generators salvaged and placed back in service—then electrical apparatus can be said to be rugged, indeed. Such was the experience of the Bureau of Power and Light of Los Angeles in the disastrous flood following the failure of St. Francis Dam last spring, which wrecked San Francisquito plant No. 2, belonging to that organization.

The superstructure of the power house was rebuilt and the plant placed back in service recently with practically all of the original major equipment. The most serious damage was to one of the generators which was running at the time the 125-ft. wall of water moved down upon the plant. Scouring and rock crusher action badly damaged this machine; nevertheless, new bearings, straightening of the shaft, partly new laminations, new stator coils and rebuilding of the field coils and exciter were all that were necessary to place the machine in condition for service. Conditions before and after the failure and the present appearance of San Francisquito are illustrated on page 380 of this issue.

Methods and equipment had to be improvised on the job to cope with the unprecedented problems presented, and that the plant was completely rebuilt and placed in service in the short period of slightly over seven months, utilizing original equipment, is a credit not only to the engineers who handled the job but to electrical manufacturers and the electrical manufacturing industry of this country for the rugged and substantial manner in which equipment is designed and assembled.

"Shotgun" Fuse Solves High-Tension Problem

Gunpowder ignited by fuse action gives ultra high-speed operation and large interrupting capacity

By J. P. Medlin

*Plant Foreman Great Falls Power Company**
Northern Division, Great Falls, Mont.

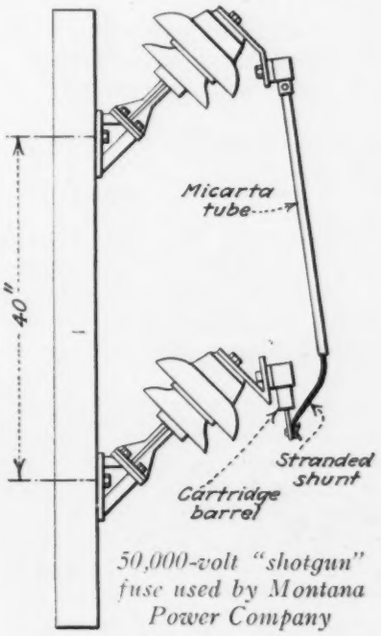
MANY of the difficulties encountered in high-voltage fusing have apparently been solved by a new device recently developed by the Montana Power Company for use on its transmission system. This device, known as the "shotgun" fuse, represents a radical departure from former practice and is unique in performance and application. The fuse consists essentially of two parts, viz., a thermostatic cartridge or valve, which is placed on the lower terminal, and the tube which bridges across the fuse terminals and in which the circuit is broken.

The tube is made of specially treated micarta with small inside diameter with heavy wall. In this is threaded a stranded flexible copper wire known as the shunt, which is held in a metal ferrule on the upper end of the tube by a friction grip. The lower end of the shunt extends beyond the lower end of the tube and connects by means of a wing nut to the terminal of the cartridge. This cartridge consists of a 12-gage empty and primerless paper shotgun shell in which is placed a suitable thermostatic wire about ¾ in. long, which in turn is surrounded with a few grains of black gunpowder, a terminal brought out, and the whole contents soundly wadded in and waterproofed. The correct loading and rating of these cartridges has been brought to a high degree of reliability after a long period of experimentation and rigorous testing.

When the current through the cartridge heats the thermostatic wire to the ignition point of the black powder the latter explodes, jerking the shunt loose from the friction grip in the upper end of the tube and violently pulling it out of the tube, breaking the circuit. It is noteworthy that fuse action is the same, whether from overload or short circuit. This eliminates the serious defect found in the ordinary expulsion fuse of the tube burning up when the fuse melts on a gradual overload. The extraordinarily high speed with which the shunt is jerked from the tube gives great current-interrupting capacity and insures very little disturbance to other customers.

The essential features of the new fuse are shown in the accompanying drawing, which represents a conventional 50,000-volt assembly. Parts include the barrel holding the cartridge, the tube and the shunt extending from tube to cartridge. Note that after fuse operation an air gap remains between the lower end of fuse tube and the lower fuse terminal. This effectually prevents destruction of the tube by leakage when the circuit is open. In the preparation of the shunt suitable means are provided so that the correct length always extends from the lower end of the tube. Cartridge ratings so far developed range from 1 amp. to 50 amp., these being safe load ratings; that is, a cartridge rated at 5 amp. will carry that current indefinitely. A unique feature is that instantaneous operation is obtained at not more than 40 per cent increase above the safe load rating. Thus the 5-amp. fuse will operate instantly at 7 amp., but gives continuous reliable service at 5 amp.

To those experienced in high-voltage fusing problems it is well known that a large percentage of fuse actions and failures arise from troubles originating within the fuse itself. The conventional expulsion fuse in common practice is generally loaded with at least 100 per cent margin above full load current. Even at this double rating the fuse wire often attains a high operating temperature because of the necessity of placing its blowing point at the fusing temperature. The intermediate temperatures where the fuse wire increases from black heat to red heat, to bright incandescence, etc., represents a very unstable condition which is greatly magnified by changes in ambient temperature. This defect of the ordinary fuse results in the gradual disintegration of the wire or ribbon and the eventual destruction of the tube if new refills are not installed at frequent intervals. For voltages of 40,000 and above the action of corona becomes a factor in fusing. The fuse wire gradually loses cross-section and if not renewed regularly there is further danger of destruction of the tube or an undesired outage.



50,000-volt "shotgun" fuse used by Montana Power Company

A fusible link surrounded by gunpowder in the shotgun shell ignites the powder, blowing out the wadding attached to the flexible shunt with great force and breaking the circuit in the micarta tube.

The new fuse appears to solve these problems very satisfactorily. The thermostatic element is entirely shielded from corona and the effects of weathering. The element being very short (about ¾ in.) and the terminals to which it is connected very large, heat is conducted away from it quite rapidly. Its cross-section for any particular current is therefore very small in comparison to the ordinary fuse wire and the influence of ambient temperature proportionately less. In addition, its normal operating temperature being very much below a black heat, deterioration from scaling is entirely eliminated. These factors combine to insure freedom from failures due to troubles within the fuse itself, guarantee remarkable reliability of calibration and give promise of long life for the fuse elements. A further in-

WE MUST not resent criticism. If it seems unjust, we must point out the injustice—patiently and in good temper. If it is deserved, we must readily, cheerfully admit it—and do better.

—P. S. Arkwright,
President Georgia Power Company.

**Subsidiary of the Montana Power Company.*

teresting feature is that reliable fusing is now made possible for very low amperages at high voltages. By the use of thermostatic wires of high-resistance alloy and small cross-section it is possible to rate as low as $\frac{1}{10}$ amp.

This new fuse has been adopted for general use by the Montana Power Company and is being used for voltages ranging from 6.6 to 65 kv., while fuses for 102 kv. are now being developed. Satisfactory and uniform results have been obtained and a great saving in upkeep has been effected.

Assembly Work Improved by Electric Heaters

Heating of bore and hub of large generator electrically facilitates installation. Time and need for supplemental equipment minimized

By E. L. Doty

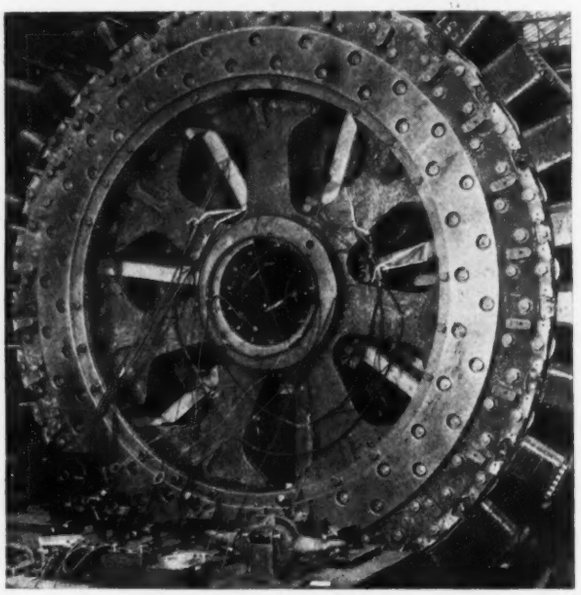
Service Department,
Westinghouse Electric & Manufacturing Company

PLACING shafts in the rotating elements of large apparatus has been one of the most difficult and expensive operations handled in the field. The use of electric heaters to expand the hub bores of large rotors greatly simplifies this work and provides a very satisfactory method for such assemblies.

Electric heaters of the space-heater type are particularly suitable equipment for expanding the bores of rotors and they are especially applicable when such operations are carried on at remote locations, where space is limited or when facilities for handling apparatus are not good. Such heaters may be placed in the bore, bent around the spider hub, fitted along spokes or placed in dovetail slots or keyways; they may be so located that almost any desired temperature gradient may be secured. They should be held firmly in contact with the apparatus by wires or wedges. Temperature control when heaters of this type are used is exceedingly simple and may be made to meet almost any desired condition by connecting the heaters in circuit in suitable combinations.

In the assembly of a 33,000-kva. vertical waterwheel generator fourteen 1,250-watt, 110-volt, 43-in. space heaters were placed within the bore and held in position by a ring suspended at each end of the hub. They were held against the inside of the hub by two light steel rings. Four 500-watt, 125-volt, 24-in. space heaters were placed around each end of the hub. They were secured by simply tying the ends together with wire. Although the hub of this rotor was 48 in. long, the design of the outside was such that only short heaters could be used and make good contact with the steel. Accordingly 42 220-watt, 125-volt, 12-in. space heaters were installed, six being located between each two arms of the seven-arm spider.

The 220-watt and the 500-watt heaters on the outside of the hub were considered "base heat" and the 1,250-watt heaters inside the bore were intended to force the hub expansion and for temperature control. As the rim of this steel spider was of the "open arch" construction, supporting a laminated ring to which the field poles were keyed, it was unnecessary to place heaters on the spider arms or on the rim. With only a tarpaulin covering over the rotor the temperature gradient was well within safe limits.



Space heaters arranged in the bore and on the hub of a 33,000-kva. vertical waterwheel generator

Thermocouples were suitably located to indicate the temperature of the inside and of the outside of the hub and also that of the rim, and readings were taken every half hour until a suitable temperature was attained, then every hour until the desired bore expansion was secured. Micrometer bore measurements were made at stated intervals.

When the micrometer measurements indicated a sufficient bore expansion it was only necessary to throw off the tarpaulins, to open the circuit for the heaters within the hub bore, to cut the wires securing the heaters to one supporting ring and draw out of the bore the heaters suspended from the other ring, then to coat the bore fits with graphite and oil and to slide the shaft into the hub. In less than fifteen minutes from the time the heat was cut off the shaft was in place in the rotor.

It is apparent that the expense incurred in assembling this rotor and shaft was but a small part of what it would have cost to provide, transport to a remote location and install a press of sufficient capacity to force the shaft into the rotor bore. Further, the time required for the set-up and assembly was probably much less than that which would have been required had a press been used.

Shaft Installation Data

Weight of complete rotor (pounds)		255,000
Weight of cast steel spider (pounds)		23,900
Weight of laminated rim (pounds)		132,800
Weight of field poles and coils (pounds)		64,000
Weight of shaft (pounds)		28,100
Length of shaft (inches)		276
Width of hub (inches)		48
Thickness o fhub, average (inches)		6
Diameters of hub bores (inches)		23.750 24.000
Diameters of shaft at hub fits (inches)		23.758 24.008
Electric heaters installed (watts)		30.740
Electric space heaters used	Outside of hub 13,240 watts (hours)	9¼
	Inside of hub circuit No. 1—8,750 watts (hours)	6
	Inside of hub circuit No. 2—8,750 watts (hours)	1¼
Total kilowatt-hours		192
Total time required to expand bore (hours)		9¾
Bore expansion obtained, average (inches)		0.026

Automatic Frequency Control

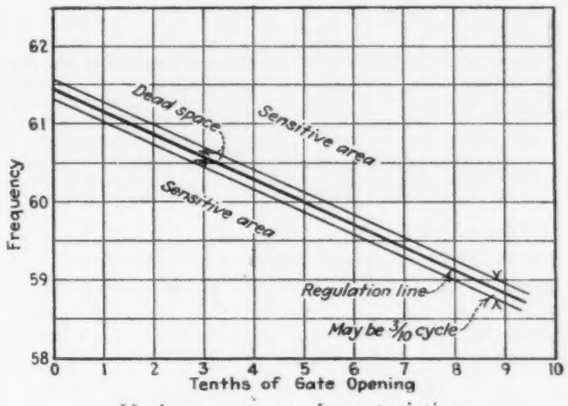
Underlying operating requirements. Experience in New England. Interconnected system promising. Trend toward combining frequency and load control

By Robert Brandt

Operating Department, New England Power Company, Boston

THE automatic control of frequency has received considerable attention in the past year and some promising results have been achieved already. A few experimental and a few permanent installations have been made and much valuable experience has been gained. The present large number of interconnections, with the attendant problems of maintaining desired power flow between systems, and the policies of some distributing companies with regard to time selling have demanded close study of the problem of keeping the variations from the normal 60 cycles as small as possible.

The governors with which either hydro or steam units are equipped are entirely inadequate for holding the frequency within the required narrow margins unless assisted. A hydro governor with its inherent regulation characteristics of, say, 5 per cent would permit the frequency to vary 1.5 cycles on either side of 60 from no load to full load, which is of course too large a deviation to be permitted. Even if the regulation were only 2 per cent, as on some steam units, there would be a variation of 0.6 cycle, which is, under present conditions, just as unsatisfactory. This situation is controlled through the use of synchronizing motors on the governors as adjusted from time to time by the station operators and has the effect of moving the "regulation line" parallel to itself until it intersects the horizontal 60-cycle line at the desired new load. An added complication results from the fact that the "regulation line" is not a line at all, but a band which may be as much as $\frac{3}{10}$ cycle wide between upper and lower limits. A governor may come to rest anywhere in this band, or dead space, and it will then not come into action again until the frequency has changed enough to move the point of operation into the sensitive region. Thus it is quite possible for a speed change of, say, $\frac{1}{10}$ cycle to go completely unnoticed by the governor. Of course with a large system on which there are several generating units, some of them will always be just at the edge of the band and ready to correct even the slightest deviation, if it occurs in one direction, but they will be decidedly slow in response if the error is in the other direction. These conditions have always existed in the past under hand regulation and they will continue to exist under any other method, so that their effect may be considered as introducing no new phases into the regulation problem.



Hydro governor characteristics

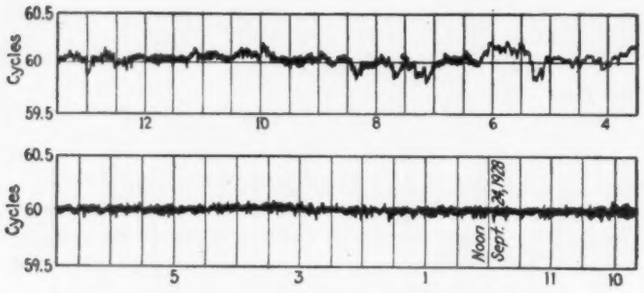
Whether a machine could be devised to supplement or replace hand control was the first problem. In general, it may be said that whenever the same set of physical conditions calls for the same actions in correcting them, and those conditions are not too complex, a machine can be devised which will do the work as well as the human operator, and in many cases better, inasmuch as a machine can be relied on to be more constantly on the watch for error than the man who is forced to divide his attention between several duties.

The first automatic frequency control devices were built to recognize one fundamental condition of error, namely, a departure of the instantaneous frequency from the standard 60. It later became apparent that the conditions which had to be recognized were not as simple as they first appeared, and that the instantaneous departure from 60 should not be the only thing taken into account as a basis for correcting the speed on a large interconnected system. It is not difficult to set down the requirements which an ideal automatic frequency controller should fulfill. They are presented, in brief, on the following page.

On the New England Power System there has been an automatic controller under developmental test since July, 1927, and in constant service since February, 1928. This work has been done at the Harriman station, a hydro plant on the Deerfield River,

Automatic frequency control is making rapid progress these days. We are fortunate in being able to present in this issue a clear-cut statement of the problem by Robert Brandt of the New England Power Company's operating department at Boston supported by over a year's experience on this important interconnected system. Speed can now be held in general within a total band width of 0.1 cycle by automatic control. Engineering thought is now being given to coming requirements of combined load and frequency control over considerable areas.

near the Massachusetts-Vermont line, which contains three 15,000-kw. units operating at 360 r.p.m. under a gross head of about 360 ft. The New England Power System is widely interconnected, notably with the Edison Electric Illuminating Company of Boston to the east, with the Montaup system to the southeast, the Connecticut Valley Power Exchange to the south, the New York Power & Light Corporation to the west and the New England Public Service Company to the north. During the heavy load periods of the day the interconnected load is well up toward 1,000,000 kw.



System frequency charts under hand (upper) and automatic (lower) control

Two different types of apparatus have been used, one developed by the Leeds & Northrup Company and another developed by the Warren Telechron Company, working on entirely different principles. The former makes corrections based on what might be termed periodic snapshots of the instantaneous frequency; the latter has for its standard the integrated time error of the system over an exceedingly short period. The standard 60 cycles is determined in the former case by an impedance bridge and in the latter by a seconds pendulum. For experimental purposes a change-over switch has been installed at the Harriman plant permitting a rapid shifting from one control apparatus to the other. It does not seem necessary to go into a detailed description of the mechanism, results and principles being considered at this time as more important than the physical means of their attainment.

The results obtained by either of the automatic machines can best be shown by means of sample curves. The system frequency as controlled by the hand method is shown in an accompanying figure, as is that obtained with automatic machines in service. For illustration, it is not essential which make of apparatus drew the sample chart, since the results obtained from each are very similar. In general, it may be said that automatic control is capable of holding speed within a range of $\frac{1}{20}$ cycle either side of normal, or within a total band width of $\frac{1}{10}$ cycle.

The charts show only the instantaneous frequency. Automatic regulation is also reflected in the integrated frequency. The Warren apparatus, operating on a time error principle, will hold the clock deviation down to an entirely negligible point. The Leeds & Northrup apparatus, which holds integrated frequency only as a byproduct of instantaneous frequency, will keep the accumulated error within a very few seconds an hour and practically at a point where there can be no reasonable complaint of clock errors.

The experience which has been gained with both types of apparatus shows that the mechanical details of construction, as might very well be expected from any developmental work of this sort, have not yet reached a point where they may be considered as entirely reliable or final. It is felt, however, that the underlying principles are sufficiently well established to give every assurance that the mechanical details can be worked out to result in satisfactory operation over a long period without excessive maintenance or inspection.

The point has often been raised that any automatic control apparatus which results in actuating the synchronizing motors for short periods, but repeated every few seconds, imposes a service on the governor parts which was never contemplated when the governors were built, and that excessive wear might result, particularly on the wicket gate pin bushings, or on the mechanism through which the motors act. The only provision which has been made to counteract this danger has been to increase the "aleming" schedule on the gate bearings. After an extended period of watching, it appears that the results have not been detrimental. It cannot be denied, however, that the service is hard and the venturi meter flow charts furnish ample evidence that the gates are actually being moved very much more frequently than was the case even under the best previous conditions of hand regulation.

It is interesting to consider the amount of capacity which is required to regulate satisfactorily the frequency of a system. If the total interconnected load is in the neighborhood of, say, 400,000 kw. and the load includes a

Fundamental Requirements

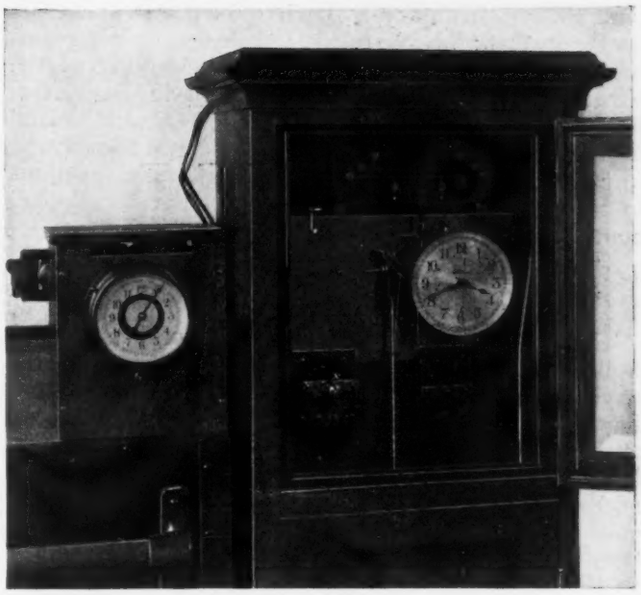
1. The apparatus should be sensitive and fast. It should not permit an error of more than 1/30 cycle to go unnoticed and it should not delay more than ten seconds before making a move toward correction of the minimum error. Larger errors should be attacked more quickly.
2. The magnitude of the correcting impulse should be dependent upon and proportional to the magnitude of the error, and should consider whether the frequency is going away from normal or tending to correct itself.
3. The apparatus should be capable of changing the load on a station over its entire range as quickly as the load itself is likely to move during the fast-changing periods. With all this, however, it should be dead-beat and show no tendency to hunt.
4. The control should be flexible. If the installation is in a station containing several units suitable for regulating, it should be possible to put the control on any desired combination of the units.
5. The apparatus should be of simple and rugged construction and should be able to hold its adjustment, which of necessity must be fairly delicate.
6. Any auxiliary apparatus involved, and in particular that which is installed on the governor on the operating floor, or in the pit, should be reduced to a minimum.
7. The controller should be equipped to cut itself out of action whenever the units on which it is operating have reached either the high or low limits of output, and it should be possible easily to change the position of the limit stops.
8. The apparatus should not offer any operating hazard, and in an emergency should either cut itself clear of the station or should be exceedingly easy to cut clear.
9. The controller should work in a satisfactory manner in conjunction with other units or plants similarly equipped, but not necessarily supplied by the same manufacturer. That is, there should be no tendency for load to be transferred from unit to unit, or plant to plant, or from one interconnected system to another, merely because of the existence of one or more sets of automatic control apparatus.

certain amount of rapidly fluctuating types, such as traction customers or rolling mills, it may well be that from 20,000 to 30,000 kw. capacity is needed. As the size of the interconnected load increases, however, the size of the regulating capacity required does not increase in proportion, and, in fact, may be found to diminish.

This situation is entirely as might be expected in view of the fact that regulation is accomplished only on the fringe of the load curve and that the addition of more load has a tendency to smooth out irregularities of the original load, and to leave as a net result a fringe which is of no greater magnitude than before.

Economic Aspects of Regulation

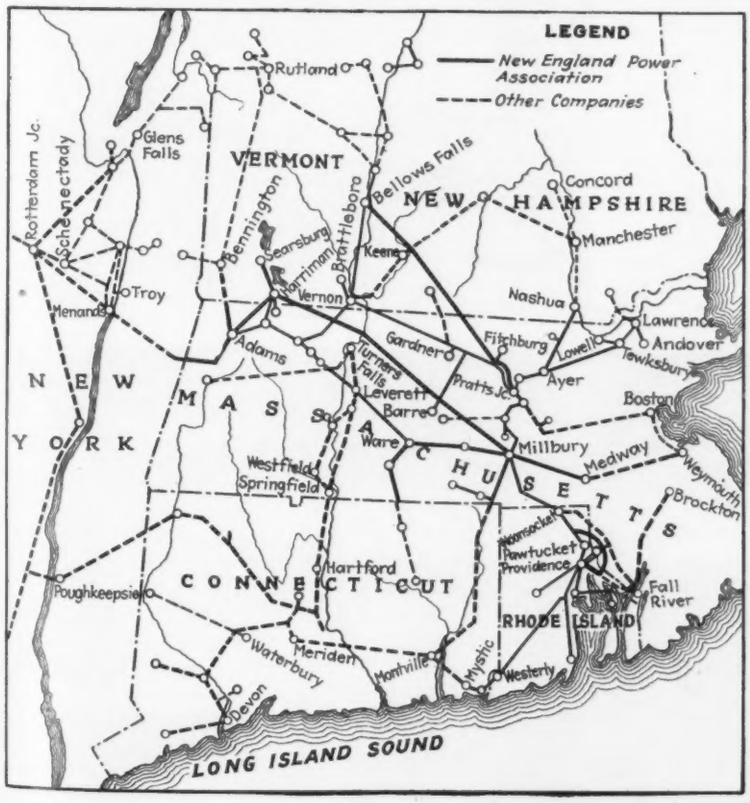
Frequency regulation must be admitted to carry with it a certain amount of expense, because from its very nature it involves constantly changing the load on one or more units and thus prohibits operation at the most economical point. Most systems prefer, when the choice offers, to regulate on hydro rather than on steam, not necessarily because of differences in the part gate efficiency of the one or the other, but because it is easier to change the flow of water into a wheel than it is to raise and lower the steaming rate of boilers repeatedly at short intervals. There are very few systems on which the regulation is at all times accomplished in the same plant. For example, it is economically advisable to carry full load on run-of-the-river plants during flood periods, and water conditions may require a storage plant to run at some set output, or even not to run at all, during certain periods. It may also be necessary to shift the point of regulation during any 24-hour period. Systems regulating on steam may find it economical to use one plant for the purpose when the total load is heavy, during the day period, and a different one during the lighter hours of the evening and night. Thus it appears that if automatic control is to act at all times of the day it must be installed at each station where it may be desired to regulate.



Warren automatic master clock frequency controller

At left is unit controller, one being required per generator. At right, upper part of master pendulum assembly.

Obviously the economy would be greatest if the load fluctuations could be divided to such an extent that the amount on any one station would become negligible. This calls, however, for a great multiplicity of apparatus and much added complication. If the control must be, from the nature of the system, all concentrated on one steam plant, then it may even prove necessary to allow a comparatively large drift from normal before correction is made, so as to avoid rapid fluctuations in steam consumption, which may result in entirely unsatisfactory boiler and furnace conditions. In a case of this sort, it is equivalent to saying that the full advantages of automatic control cannot be realized.



Transmission lines of New England Power Association and major high-tension connections

Load Control in Prospect

In considering what the proper distribution of automatically controlled stations will be in the future, and how the settings in the various stations might differ, suppose a sample case of two systems with one tie connection and a straight frequency controller at one plant on each system. It is highly desirable, of course, that each system should regulate for its own fluctuations in load and not interfere with any desired flow of power one way or the other over the tie line.

If the load characteristics of the two systems are of the same nature, then the increases and decreases will come on each at about the same time and each controller, as it notices and corrects for an error in frequency, will automatically handle its own share of the regulation required. If the bulk of the load change, however, should come on one system, then the automatic controllers, while bringing the frequency to normal, would necessarily upset the steady flow of power over the tie line. From this it appears that it may be necessary to incorporate

with straight frequency controllers some sort of tie line load control. In the case considered above such a development would undoubtedly be fairly simple, but as the situation grows more complicated, by having many systems tied together, and not with one but with several connections between systems, the problem becomes so intricate that the development of satisfactory apparatus to accomplish all the desired results automatically still appears to be in the distance.

Master Control May Be Shifted to Various Points

Then, also, comes the question of the settings of controllers at various points. Should they each be of the same sensitivity, or would it perhaps be more satisfactory to have one station act as a master and have all the other stations so set as to come into action on large load changes which might be outside the range of the master station? This latter method might be quite satisfactory for several stations on the same system, but if it were extended so that one station would be the master for an entire district a hardship would be worked on the master system, which would then be doing more than its share of the regulation. One method of overcoming this difficulty, if the correctness of the master station principle is established, would be to have the various systems agree periodically to allow a plant, now on one system and now on another, to act as master, by means of some simple adjustment of sensitivity which would be provided on the apparatus.

There is yet another feature of automatic control which promises to be of growing importance and that is the combination of straight frequency control with some apparatus which will consider the actual load on the control station. In steam plants particularly this combination appears to have attractive and even necessary qualities. A plant so equipped, while being required automatically to keep within a fixed divergence from the desired and presumably the most economical load point, would nevertheless be free to swing to a certain extent as frequency variations required.

In conclusion, it appears that we may expect to have available in the not too far distant future automatic apparatus which will not only control frequency within far closer limits than is practically feasible by hand, but will also be adapted to the maintenance of a plant or unit load schedule in conjunction with its other functions.

Airport Lighting Improved by High-Power Portable Projector

CIRCULAR lenses and mirrors, ordinarily used in searchlights and floodlights, are entirely absent in a new type of airport floodlight shown recently at the International Aeronautical Exposition at Chicago. The new light, developed by C. A. B. Halvorson of the General Electric Company, contains fourteen high-power incandescent lamps, giving a total of approximately 3,000,000 beam candlepower. The lamps are arranged in a row in front of a half dozen cylindrical mirrors that spread the light over the field without permitting it to rise high enough to interfere with the vision of pilots landing directly into the beam of the powerful floodlight and blinding them.

At a distance of a mile from the floodlight there is sufficient illumination so that a newspaper can be read, and at 2,500 ft., the average maximum airport distance, the illumination is sufficient so that landing pilots can quickly and accurately determine the nature of the landing surface.

The incandescent lamps, which are specially designed for aviation purposes, operate on 32-volt circuits and use 1,500 watts each, making the total load of the new unit 21 kw. They are gas-filled, with tubular bulbs to care for heat radiation.

3,000,000-cp. airport lighting unit effective over half-mile range

Electrically Heated Houses

Practicability studied by comparing three test installations. Nature of homes and equipment. Power demands and energy consumption. Cost of installations

By E. B. DAWSON and J. F. LAMB
Westinghouse Electric & Manufacturing Company

THE general conditions under which tests were conducted near Pittsburgh by the Westinghouse Electric & Manufacturing Company, Duquesne Light Company and Armstrong Cork & Insulation Company to determine the energy consumption and power demand for heating homes electrically were presented in the January 12 issue of ELECTRICAL WORLD. In general, comparisons were made of two houses heated electrically and one heated by non-automatic coal firing. Graphs were presented showing duration of temperature conditions and corresponding energy consumptions and power demand. The type of house insulation used in one electrically heated home was illustrated and eight conclusions were presented. In this issue more details of the test are given.

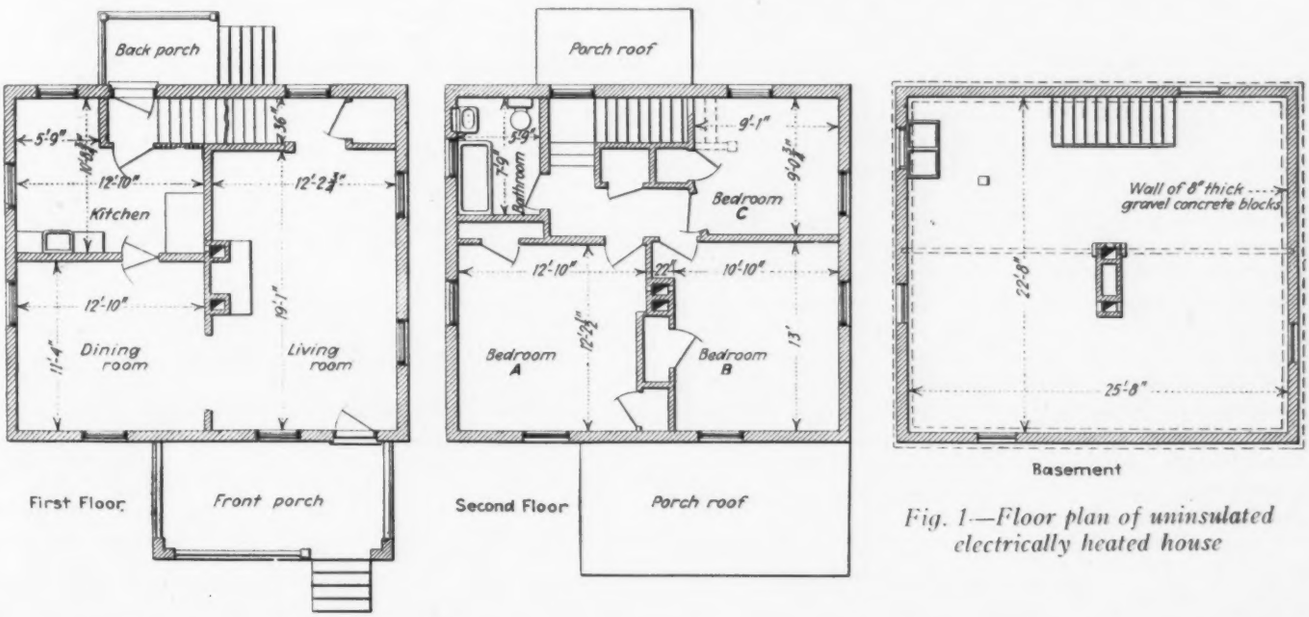


Fig. 1—Floor plan of uninsulated electrically heated house

Aside from the cork insulation, the two electrically heated houses had a few minor differences in construction. The cork insulation reduced the inside dimensions of the insulated house by a very slight amount. Some of the windows in the cork-insulated house were smaller than the corresponding windows in the uninsulated house. The front door of the cork-insulated house had a larger glass area than the front door of the uninsulated house, etc. Table I gives additional data on the two electrically heated houses.

The small windows each had an inside perimeter 23 in. wide by 46 in. high, with two panes of glass, the upper 20 in. wide by 20 in. high, the lower 20 in. wide by 21 in. high. The large windows each had an inside perimeter 29½ in. wide by 56¾ in. high, with two panes of glass each 26 in. wide by 26 in. high. The basement wooden windows each had an inside perimeter 28½ in. wide by 20½ in. high, with two 11¾ in. wide by 15½ in. high panes of glass. The metal window was approximately the same size. The two doors each had an inside perimeter 31½ in. wide by 78 in. high.

There was an inside door opening from the kitchen into the stairway to the basement.

There were some minor differences in room dimensions between the uninsulated and the cork-insulated houses caused by the cork insulation, arrangement of closets, etc. As regards floor plan and approximate over-all dimensions, the two electrically heated houses are practically the same.

All windows and doors in the electrically heated houses were weatherstripped, calked and fitted with storm sash, with the exception of one metal basement window in each house.

In addition to the two electrically heated houses, data were obtained on an uninsulated coal-fired house with a non-automatic hot air heating system. The coal-fired house was practically identical in construction and size of rooms with the uninsulated electrically heated house, the main difference being that the floor plan of the coal-fired house was of a left-hand type, with the front porch, living room and bedroom B on the left side of the house, while the electrically heated house had a right-hand floor plan as shown in Fig. 1. The coal-fired house also had an additional door from the outside into the basement.

The houses are all located on a street which is on the

Table I—General Data on Electrically Heated Houses

Room	Height of Ceiling, Ft., In.	Approximate Dimensions of Room, Ft., In. Ft., In.	Approximate Floor Space, Sq. Ft.	Approximate Volume, Cubic Feet	Windows and Doors Electrically Heated Houses: Uninsulated House	Windows and Doors Electrically Heated Houses: Cork Insulated House
Bedroom A	8- 0	12- 7x12-10	161	1,288	Two large windows	Two large windows
Bedroom B	8- 0	10-11x13- 0	162	1,296	Two large windows	Two large windows
Bedroom C	8- 0	9- 3x 9- 9	90	720	Two large windows	Two small windows
Bathroom	8- 0	5- 9x 8- 0	46	368	One small window	One small window
Stairway between first and second floors	.....	3- 0x10- 5	....	.....	One small window	One small window
Kitchen	8-5½	10-9x12-10	138	1,170	Two large windows	Two small windows
Dining room	8-5½	11- 4x12-10	146	1,238	Two large windows	Two large windows
Living room	8-5½	12- 3x19- 1	277	2,350	Four large windows and one door	Four large windows and one door
Stairway to basement	.....	3- 0x10- 5	....	.....	One door	One door
Basement	9-0	25- 8x22- 8	567	5,100	Four wooden windows and one metal window	Four wooden windows and one metal window
First floor	8-5½	25- 6x22- 6	561	4,750	.....	.....
Second floor	8-0	25- 6x22- 6	505	4,040	.....	.....
Total	.....	.....	1,633	13,890		

south side of a steep hill and are well exposed to winds. The three houses have different exposures. The uninsulated electrically heated house faces west, the cork-insulated house faces south, while the coal-fired house faces east.

All three houses were occupied during the entire test period. Two people were living in the cork-insulated house, five people in the uninsulated electrically heated house and three people in the coal-fired house. The habits of the families living in the houses of course differed markedly, so that some rooms in one house would be used more than the corresponding rooms of the other houses. The people in the cork-insulated house were away oftener than the people in the other houses, but not enough to affect the test results materially.

Comprehensive records of the power consumption in the electrically heated houses and of the inside and outside temperatures were obtained. Six recording thermometers of the three-day circular chart type were used for recording temperatures inside and outside of the three houses. In the electrically heated houses watt-hour meters were used to record the electrical energy required for heating the individual rooms and for heating the entire house. A graphic demand meter was installed in each house for recording the total kilowatt demand in the house throughout the day. A double tariff watt-hour meter was installed in each house for segregating the power consumed into two portions, that consumed from 6 a.m. to 9 p.m. and that consumed during the off-peak hours from 9 p.m. to 6 a.m.

During the portion of the test from January, 1927, to May, 1927, all three houses were completely equipped with storm sash on the windows of the first and second floors. The heating systems in the electrically heated houses were operated entirely by manual control throughout this period.

Storm doors were added to the coal-fired house for the next heating season from September, 1927, to May, 1928. The two electrically heated houses at this time had all windows and doors weatherstripped and calked, storm doors installed, storm sash put on the wooden basement windows and automatic temperature control systems with time clocks, contactors and individual room thermostats installed; 14-kw. capacity of storage type air heaters were in use in the cork-insulated house during most of the 1927-28 heating season.

For the main heating circuits 220 volts, 60 cycles was used and for the control circuits 110 volts, 60 cycles.

Table III—Storage Heaters in Insulated House

Rating, Watts	Dimensions in Inches—Height	Dimensions in Inches—Diameter	Net Weight Without Gravel, Pounds	Approximate* List Price	Weight of Gravel Required, Pounds
3,000	51.7	23.6	353	$118	320
5,000	71.5	23.6	467	157	485

*Based on an exchange rate of 23.80 cents per mark.

Table IV—Storage Heat from Off-Peak Hours

Duration of Test, Days	Cork-Insulated House: Type of Heat	Cork-Insulated House: Per Cent Used During Off-Peak Hours	Cork-Insulated House: Total Kw.-Hr. Energy Consumption	Uninsulated House: Type of Heat	Uninsulated House: Per Cent Used During Off-Peak Hours	Uninsulated House: Total Kw.-Hr. Energy Consumption
288	Instantaneous	19.7	13,560	Instantaneous	20.9	22,400
163	Stored	68.5	15,080	Instantaneous	24.8	26,880

Table II—Demand Data on Electrically Heated Houses

Date	Outside Temp. Deg. F.: Average	Outside Temp. Deg. F.: Minimum	Outside Temp. Deg. F.: Maximum	Cork-Insulated House: Kw. Maximum Demand	Cork-Insulated House: Kw.-Hr. 24-Hour Consumption	Cork-Insulated House: Kilowatt Installed Heating Capacity	Uninsulated House: Kw. Maximum Demand	Uninsulated House: Kw.-Hr. 24-Hour Consumption	Uninsulated House: Kilowatt Installed Heating Capacity	Remarks
Feb. 27, 1927	25.0	22	29	13.2	208	23	23.0	282	29	Maximum demand recorded in cork-insulated house with manual control.
Feb. 28, 1927	27.8	24	32	10.4	174	23	23.2	260	29	Maximum demand recorded in uninsulated house with manual control.
Jan. 3, 1928	2.6	—3	9	19.2	251	*37	No record	371	29	Maximum demand recorded in cork-insulated house with stored heat.
Feb. 2, 1928	19.0	12	28	14.3	168	23	24.4	265	29	Maximum demand recorded in uninsulated house. Automatic temperature control.
Mar. 13, 1927	22.5	18	27	11.4	189	23	18.5	260	29	Coldest day during manual control in both houses.
Jan. 2, 1928	0.7	—3	8	18.5	290	*37	23.0	376	29	Coldest day in the test period. Automatic temperature control in uninsulated house. Stored heat in cork-insulated house.

* Includes 14 kw. capacity of storage heaters.

Convenient outlets with 20-amp. polarized plugs were used to connect the electric heaters to the supply circuits.

The heaters most in use were either of the radiant type or of the convection type and were portable. Some of the heaters used were illustrated in the article in the January 12 issue.

Maximum Kilowatt Demand

Recording demand meters were installed in each of the electrically heated houses for recording the total kilowatt demand for heating during fifteen-minute intervals. The accompanying table shows the largest demands which were recorded.

The maximum demands with stored heat occurred during off-peak hours. The maximum demands without stored heat occurred in the morning, as shown in the demand curves Figs. 4, 5 and 6.

In very cold weather the maximum demand in the uninsulated house often exceeded 20 kw. and in the cork-insulated house it often exceeded 11 kw. without stored heat. With stored heat the maximum demand in the cork-insulated house often exceeded 14 kw. during cold snaps, when all the storage heaters would be in use.

Table IV shows how the use of storage heaters permitted most of the power to be consumed during the off-peak hours from 9 p.m. at night to 6 a.m. in the morning.

The four storage heaters used in the cork-insulated house were purchased in Germany and are shown in Fig. 2. The tall heater at the right takes 5 kw. for warming up during the night. The three other heaters are each rated at 3 kw. Fig. 3 gives a good idea as to the size of the 5-kw. heater.

The large 5-kw. heater and the 3-kw. rectangular heater were placed in the living room of the cork-insulated house, while one of the cylindrical 3-kw. heaters was placed in the dining room and the other in the kitchen.

These types of storage heater are very large and heavy and are filled with the pea gravel after they have been located in the rooms. It is desirable to wash the gravel before filling the heaters, as otherwise objectionable odors might be given off for a short time after starting. The washed gravel should be well dried because the heaters will "steam" for a while when heated up for the first time if the gravel is not thoroughly dry.

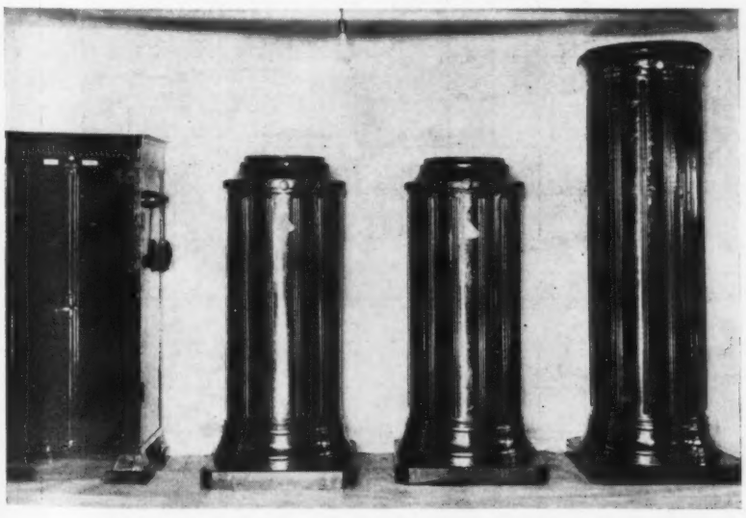


Fig. 2—The four storage heaters used in the cork-insulated house

Some information obtained from a German leaflet describing the cylindrical type of storage heaters used in the cork-insulated house is given in Table III. These figures show that when installed in the house the 3-kw. cylindrical storage heater would weigh approximately 673 lb. and the 5-kw. heater about 952 lb., including gravel.

Fig. 3—Adjusting the damper on the 5-kw. storage heater

It was noticed that the percentage of off-peak power was less on very cold days and on rather warm days than during the bulk of the weather encountered during the heating season, while storage heat was used. On the very few cold days encountered with average outside temperature around 5 deg. F. or below, the power used from 9 p.m. to 6 p.m. might drop as low as 52 per cent of the total. The reason for this was that only a certain amount of heat could be stored up with the available storage capacity. When the weather was cold enough the storage heaters could supply a much smaller percentage of the total requirements than during slightly warmer weather, the rest being supplied by the radiant and convection type heaters during the day.

Throughout the comparatively warm weather in the spring and fall it was difficult to keep from storing up too much energy in the storage heaters, so that the tendency was to use the other type of heaters available.

The storage heaters would take an appreciable time to heat up before the heat would become very noticeable in the room, so that if a quick heat was needed the ordinary radiation or convection heaters would have to be used. Conversely, the storage type heaters were slow to cool off. As a result the temperature records obtained in the rooms with storage heat were smooth lines, indicating only slow and gradual changes in room temperature.

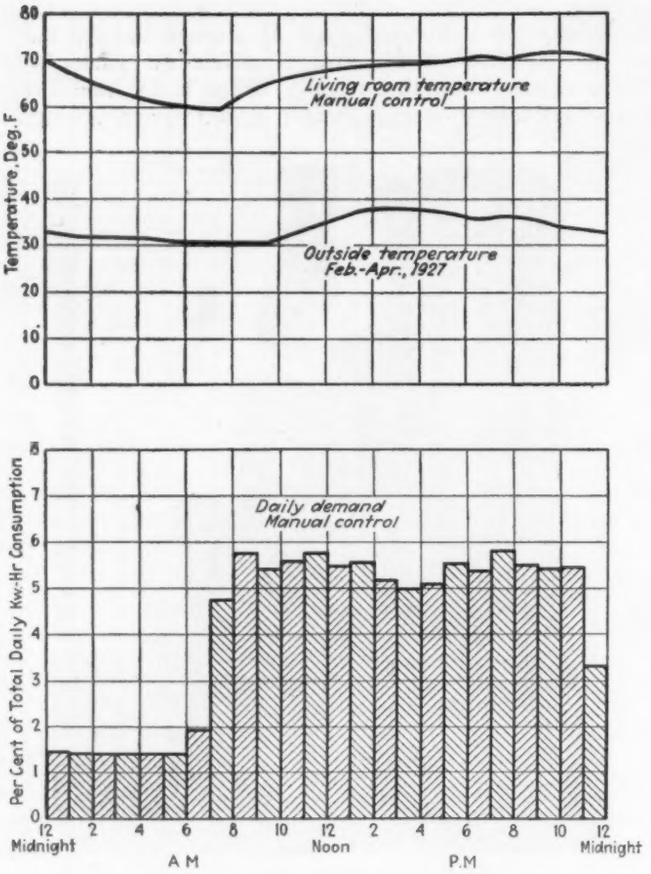


Fig. 4—Composite daily demand and temperature curves with manual control, uninsulated house

From the operating experience gained as a result of these tests, there would appear some room for improvement in the design of the storage heaters. Each of the heaters had cylindrical passages in the center, running from the bottom to the top to give a "stack" effect when the dampers were opened in the morning to let out the heat. The "stack" effect was quite noticeable when the heaters were well up to temperature, but became negligible later in the day, with the decrease in gravel temperature as the heat escaped. Much of the heat was lost through the walls of the heaters, which could have been better insulated, and there was no insulation at all in the tops or lids of the heaters.

As a result, when the storage heaters were used, the room temperatures in the early morning would sometimes reach 80 to 85 deg. F. on account of the heat escaping from the storage heaters when it was not needed. Later in the day the heater temperature would be low enough and the stack effect so small that instantaneous heaters would have to be used to maintain the room temperature at 70 deg. F.

To remedy this situation the top of the large 5-kw. storage heater was remodeled. Corkboard and asbestos heat insulation were added to the lid. A motor-driven blower was then mounted on the top of the heater with the inlet connected to the top of the circular hole running from bottom to top through the center of the heater. The heater was used in the same manner as before except that when the power to the heating elements was turned off in the morning the blower motor was connected into the circuit and controlled from the room thermostat.

Improved operating characteristics were at once obtained. On account of the added insulation in the top the heat was retained much better than before. In the afternoon and evening the blower was of great assistance in removing the heat from the interior of the heater to the room, where it was needed. The auxiliary radiation heaters could be plugged into the same circuit with the blower and be controlled by the room thermostat, in case the heat stored in the storage heater was insufficient to maintain the room temperature. The recording thermometer indicated that the temperatures obtained were usually near 70 deg. F. for the entire 24-hour period with this arrangement. The chief objection to this modification of the heater was the noise made by the blower, but this could probably be eliminated by proper design.

It is interesting to see how the distribution of energy consumption in the insulated house changed when storage heat was used:

	Without Storage Heat 288 Days, Kw.-Hr.	With Storage Heat 163 Days, Kw.-Hr.
First floor	7,425	10,329
Second floor	3,992	3,759
Ratio of first floor to second floor.	1.86	2.75

The increase in the ratio of the energy consumed on the first floor to the energy consumed on the second floor is a good indication of how the heat generated in the storage heaters on the first floor also helped materially to warm the second floor rooms. The magnitude of the change cannot be attributed to any other cause.

It would be expected that more kilowatt-hours would be consumed over a given period if storage heaters were in use than if ordinary radiation and convection heaters were used with individual room thermostats and a time

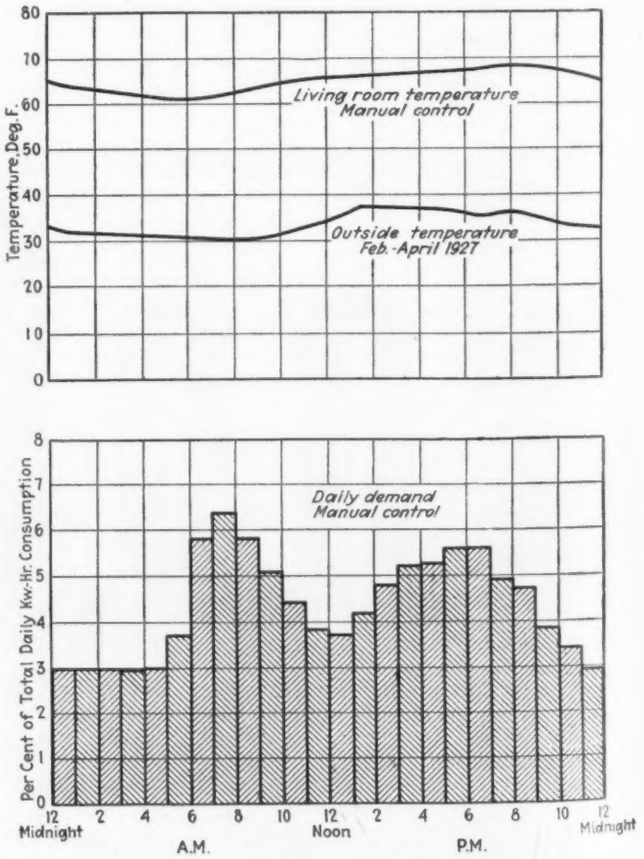


Fig. 5—Composite daily demand and temperature curves with manual control, cork-insulated house

clock in the basement to turn off the power at night. The thermometer charts showed that the average daily temperatures in the living room were higher inside the house when storage heat was in use. The average living room temperature with storage heat was 70.7 deg. F. Without storage heat the average living room temperature recorded was 66.5 deg. F. This difference can be explained partly because the storage heaters would not permit the temperature of the first floor rooms to fall very much during the night, and partly because the temperature of the first floor rooms would be very high in the morning when the storage heaters would be warmed up and emitting heat. These higher first floor average temperatures should require more heat for their maintenance and should, therefore, have increased the kilowatt-hour requirements.

An attempt was made to calculate the increase in kilowatt-hours due to these requirements, but no consistent figures could be arrived at. Neglecting the basement kilowatt-hour consumption, which should not be affected by the use of storage heat, it was found that when storage heat was used the first and second floors consumed from 0 to 7.2 per cent and on the average 4.6 per cent more kilowatt-hours per degree day than during the 40-day period from Jan. 9, 1928, to Feb. 18, 1928, when instantaneous heaters controlled by thermostats and a time clock were used instead of stored heat. This would indicate that the increase in the energy requirements resulting from the use of this type of storage heater should not be more than 8 per cent and probably around 5 per cent of the energy required when instantaneous heaters with automatic temperature control and time switches are used. These percentages are in terms of the energy requirements for the first and second floors and neglect the basement requirements, which should not be affected by the use of stored heat.

The maximum demand recorded when the storage heaters were in use was 19.2 kw. during off-peak hours on Jan. 3, 1928, when the average outside temperature was 2.6 deg. F. with a minimum temperature of —3 deg. F. Fig. 7 shows a typical daily demand curve for stored heat and illustrates how well the bulk of the power was used during the off-peak period.

The data for plotting the composite daily demand curves were obtained from the average of the fifteen-minute demand charts for six days taken from each heating season. The days were selected so as to be as much as possible representative days for the heating season.

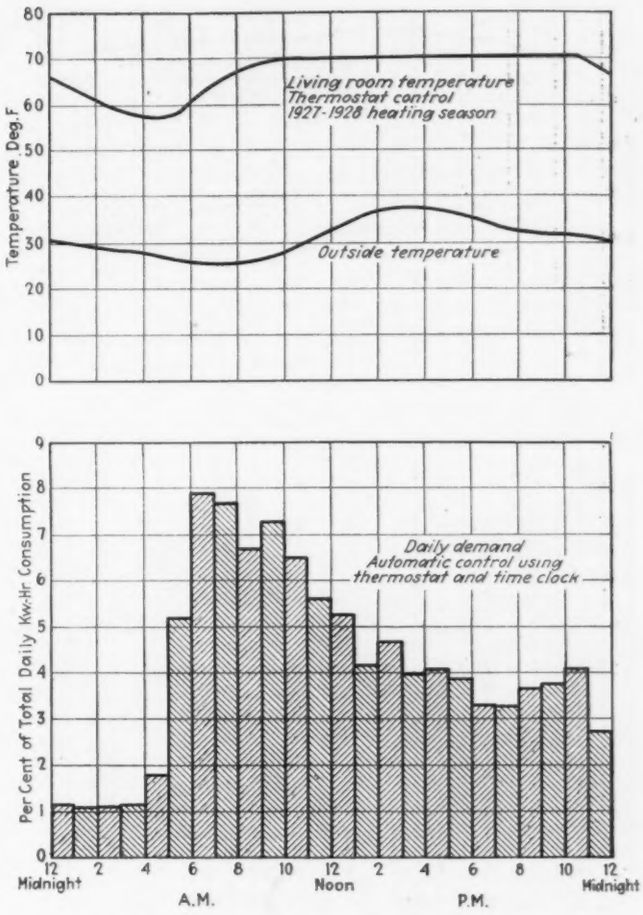


Fig. 6—Composite daily demand and temperature curves with automatic temperature control, uninsulated house

The energy consumed during each hour out of the 24-hour period in terms of per cent of the total kilowatt-hour consumption for the entire 24-hour period was determined by using a planimeter on the demand charts for each of the days in question. Averages were then taken of the percentages thus obtained for each hour. The demand curves as shown were plotted using these hourly averages as ordinates.

Tables V and VI give additional data for the days selected. Figs. 11 and 12 and the upper curves in Figs. 3* and 4* were plotted from the data for the six days in Table V, when manual control was used in both electrically heated houses. Figs. 6 and 7 and the lower curves in Figs. 3* and 4* were plotted from the six days in Table VI, when automatic temperature control was used in the uninsulated house and when stored heat was used in the cork-insulated house.

In Figs. 4, 5, 6 and 7 the temperatures throughout the day are shown in addition to the demand. The ordinates for the temperature curves are the averages of the correspondingly hourly temperatures for the six days to which the demand curves apply.

Figs. 4 and 5 indicate the difference in the demand curves for the two electrically heated houses when both were using manually controlled instantaneous heaters

Table V—Manual Control in Both Electrically Heated Houses

Date, 1927	Outside Temperature, Deg. F. Average	Minimum	Maximum	Kw.-Hr. Daily Consumption Cork-Insulated House	Uninsulated House
Feb. 22	27.3	16	40	140	292
Feb. 26	27.1	23	36	219	265
Mar. 3	22.5	18	27	188	250
Feb. 23	41.9	40	45	109	114
Mar. 26	40.6	37	47	105	170
April 2	42.8	37	47	86	109
Average	33.7			141	200

Table VI—Automatic Temperature Control in Uninsulated House, Stored Heat in Cork-Insulated House

Date, 1928	Outside Temperature, Deg. F. Average	Minimum	Maximum	Kw.-Hr. Daily Consumption Cork-Insulated House	Uninsulated House
Feb. 20	21.5	16	27	183	271
Feb. 22	22.3	9	40	150	316
Mar. 6	20.2	13	29	159	290
Jan. 7	42.0	38	48	126	152
Mar. 14	41.7	34	63	80	130
Mar. 22	40.3	34	53	95	188
Average	31.3			132	226

*ELECTRICAL WORLD, January 12, 1929.

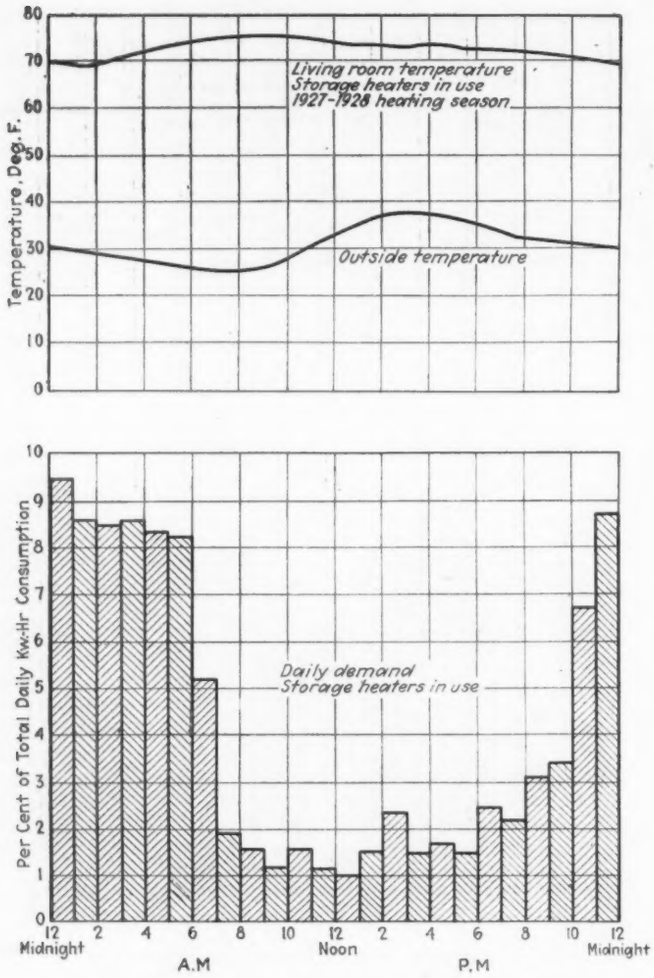


Fig. 7—Composite daily demand and temperature curves with stored heat, cork-insulated house

and illustrate that the differences in the habits of the people living in the houses affect the demand curve. In the cork-insulated house the tendency was to leave some of the heaters in the living room turned low, so that a larger percentage of the power was consumed at night. In the uninsulated house only the bathroom and basement heaters were on at night.

With manual control the demand increases in the morning after the people arise and get around to turning on the heat and then decreases after the house gets warmed up.

Fig. 6 shows the demand curve in the uninsulated house with automatic temperature control. Individual room thermostats were used, together with a time clock set to turn off all power except in the bathroom and

Table VII—Heating Requirements of Electrically Heated Houses in Different Localities

Locality	Normal Annual Degree Days	Estimated Annual Kilowatt-Hour Consumption: Uninsulated House	Estimated Annual Kilowatt-Hour Consumption: Cork-Insulated House
New York City	5,303	32,000	17,700
Chicago, Ill.	6,007	36,300	20,100
Seattle, Wash.	5,156	31,200	17,300
Washington, D. C.	4,562	27,600	15,300
San Francisco, Calif.	3,450	20,900	11,500
St. Louis, Mo.	4,583	27,700	15,300
Denver, Col.	5,880	35,500	19,700
Atlanta, Ga.	2,880	17,400	9,960
Galveston, Tex.	1,050	6,330	3,500
Nashville, Tenn.	3,550	21,400	11,900
Charleston, S. C.	1,770	10,700	5,930
St. Petersburg, Fla.	175	1,160	590
Pensacola, Fla.	1,288	7,800	4,300
Mobile, Ala.	1,439	8,700	4,800
San Diego, Calif.	1,582	9,500	5,300
Savannah, Ga.	1,517	9,200	5,100
Philadelphia, Pa.	4,950	29,900	16,600
Boston, Mass.	6,055	36,500	20,200
Richmond, Va.	3,789	22,900	12,700
Oklahoma City, Okla.	3,827	23,100	12,800
Portland, Ore.	4,449	26,900	14,900
Tacoma, Wash.	5,218	31,500	17,500
Phoenix, Arizona	1,446	8,700	4,850
Pittsburgh, Pa.	5,327	32,200	17,800

basement, from 11:30 or 12 at night to 6 a.m. in the morning. The time clock had a tendency to gain time, so that sometimes the power would come on before 6 a.m. The power being off during the night, the house would become cold. About an hour before the people arose the time clock would operate and the heat would be turned on all over the house. This caused the maximum demand to occur about 6 a.m. The demand would gradually decrease as the house warmed up so that the thermostats could operate and turn off the heat. The use of the time clock increased the ratio of the maximum to the average demand and caused the maximum demand to come earlier in the day as compared with operation under manual control. The temperature record indicates the remarkably even temperature obtained during the day with thermostatic control and is typical not only of the living room but also of most of the other rooms in the house.

Fig. 7 applies to the cork-insulated house while using the storage heaters. Most of the power was used from 10 p.m. to 6 a.m. At 6 a.m. a time clock shut off the power to the storage heaters. The instantaneous heaters supplemented the storage heaters which took the base-heating load. The heat available from the storage heaters decreased during the day, so that the demand slightly increased after the noon hour as more and more of the instantaneous heaters were used. The instantaneous heaters were controlled from thermostats during the entire 24-hour period. The heat given out by the storage heaters on the first floor tended to rise and warm the second floor to a very great extent, but had little or no effect in keeping the basement warm.

Table VIII—Installation Costs of Heated Houses

	Cork-Insulated House	Uninsulated House	Coal-Fired House
1. Cost of house alone, excluding heating system and lot	$10,000	$10,000	$10,000
2. Cost of storm doors and storm windows	178	178	163
3. Cost of weather stripping and calking	125	125	.....
4. Cost of insulating with corkboard	750	.....	.....
5. Cost of wiring for electric heat and automatic control	400	400	.....
6. Cost of control thermostats and heater contactors on basis of individual room thermostats, sylphon type	400	400	.....
7. Cost of electrical heaters (without storage heat)	309	360	.....
8. Cost of electrical heaters (with 14 kw. storage heat and necessary additional heaters)	900	.....	.....
9. Cost of coal-fired hot air heating system	.....	.....	350
Total (without storage heat)	$12,153	$11,463	$10,513
Cork-insulated house with storage heat	12,753		

The temperature curve in Fig. 7 shows that during the day the storage heaters maintained the living room at a temperature well above 70 deg. F.

It is noticeable that the use of storage heaters increased the ratio of the maximum demand to the average demand in the cork-insulated house, but that the maximum demand occurred during the off-peak hours.

Performance of the Test Houses in Different Localities

It is interesting to compare the energy requirements which were found at Forest Hills with the energy which would have been required for the test houses in other localities. This can only be done approximately.

The frequent practice in calculations for heating installations is to assume that the fuel requirements for the year will vary directly as the number of degree days.

From May 31, 1927, to May 31, 1928, 6,186 degree days were recorded during the heating season at Forest Hills. During the same period the uninsulated house consumed 37,270 kw.-hr., while the cork-insulated house consumed 20,650 kw.-hr. This makes the kilowatt-hours per degree day 6.03 for the uninsulated house and 3.34 for the cork-insulated house.

The average number of degree days per year for almost any locality in the United States can be calculated from U. S. Weather Bureau records or can be obtained from other sources (1). Table VII shows the kilowatt-hours that it is estimated the electrically heated houses at Forest Hills would have required if located in different localities of the United States. The values for the average annual degree days were taken from the Iso-degree day chart in the September, 1925, issue of the *Heating and Ventilating Magazine* (1).

These figures are, of course, only approximations and contain several sources of error. For instance, it is not likely that a house in Galveston, Tex., would be equipped with storm sash or would be as well insulated or weather stripped as the houses at Forest Hills.

The available data as to the degree days is not likely to be as accurate in per cent for the warmer localities as for the colder portions of the country because the degree days in practice are calculated, using the mean monthly temperatures. Also, the tendency, at least for the houses at Forest Hills, is to operate the thermostats at slightly lower settings in some of the rooms during the spring and summer months. However, it is felt that these values should give a rough comparison of what might be expected in the different localities.

There are a few installations of electrically heated houses in the Eastern States, where the houses are used only as summer homes from May to October. During the 163-day period from April 30, 1927, to October 10, 1927, the kilowatt-hour consumption for heating in the uninsulated house was 1,476 kw.-hr and for the cork-insulated house 795 kw.-hr.

Cost of Installation

The figures in Table VIII are estimates of costs to the average person who would provide a house and install a heating system similar to those actually in use during these tests on the basis of the cheapest available individual room thermostats and the omission of all unnecessary wiring.

If thermostats were available, which could interrupt the heater current directly, the cost of wiring and control, including thermostats, could probably be reduced from the above figure of $800 to $570.

The cost of storage heaters includes installation costs and would be subject to considerable variation under the present conditions.

Conclusions

The cost of electric heat is large enough at present to prevent its use by most of the population in cold climates. Its great convenience should make it a present competitor of other forms of heat in favorable localities, especially for the wealthier classes. If the domestic rate for electric power would fall as low as 1 cent per kilowatt-hour, a considerable electric heating load could probably be built up in many parts of the country with the proper encouragement from the central stations.

Heat insulation and a tight construction are very desirable for electrically heated houses. The amount of heat insulation which it is economical to use increases with the cost of power and with the kilowatt-hour requirements for heating.

The electric heating load is very sensitive to weather conditions and will closely compare with the degree day curve throughout the year. The relative demand throughout the day is dependent upon the habits of the users and the type of control used in addition to the changes in outside temperature from hour to hour.

Storage heaters can be used in the colder climates for successfully using the bulk of power during off-peak periods. On account of their operating characteristics, their use is not justified except where the off-peak power rate is very low, where a large number of kilowatt-hours is required and where these conditions cause the cost of electric heat to compare favorably with other forms.

As a source of heat to be used during only a part of the year or as an auxiliary to the main heating system electricity would not appear to be prohibitive in cost to some of the wealthier portions of the population. In this connection architects and builders can play an important part by designing and constructing homes of the more expensive types arranged and wired for a greater amount of auxiliary heat than has been the practice.

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Building Revenue
from Street Lighting

Higher efficiencies of large capacity lamps permit utility to increase income while supplying greater relative amount of light. Selling methods used to raise lamp wattages

By R. J. MALCOMSON
Public Service Company of Northern Illinois, Chicago

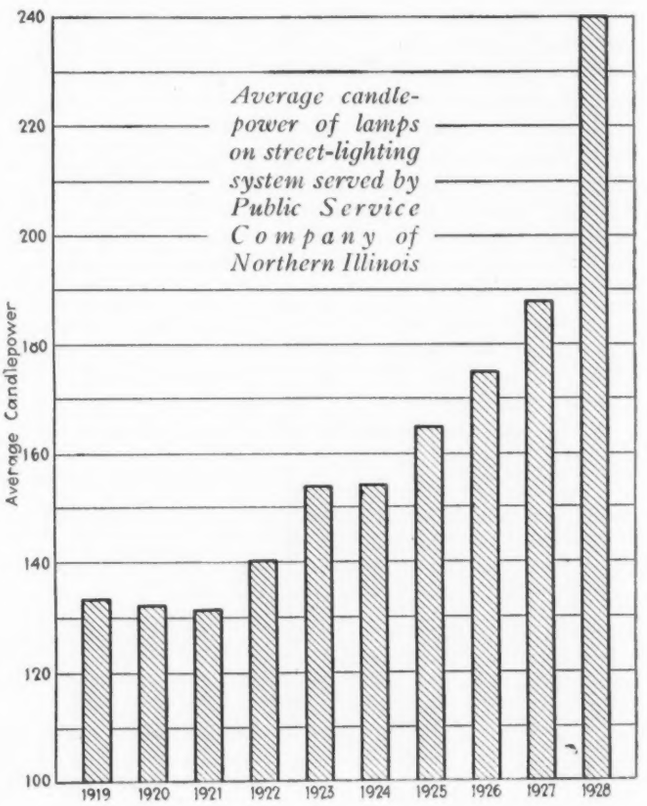
STREET-LIGHTING promotion was undertaken in an aggressive way by the Public Service Company of Illinois in 1923. At that time the revenue from this source was small and the communities in its territory could not, by any stretch of the imagination, be considered to be well lighted. Sixty candle-power lamps were the most commonly used and limited burning schedules were much in vogue. The company believed that street lighting could be sold and deveolped with the same energetic sales effort characterizing its other commercial activities. The street lighting sales division, then organized, included an engineer whose duty it was to co-operate with municipal officials, civic organizations and others interested and to work up detailed and comprehensive plans for street lighting in the various cities, towns and villages.

While "white-way" and ornamental installations were encouraged, the company early reached an appreciation of the fact that such systems were being actively sold by manufacturers and contractors who offered engineering and advisory services to prospective buyers, but that little information, or none at all, was available to the town that could not afford a new ornamental installation and desired to make the most of the existing purely utilitarian system. In recognition of this fact, the company devoted a great deal of the sales promotion work to showing to the municipalities the disadvantage of using low candlepower units such as the 60-, 80- and 100-cp. series lamps. The economies of the larger lamps of 259, 400, 600 and even 1,000 cp. were set forth by means of charts and comparative bills for illumination received, with the result that in practically all cities, towns and villages served by the company the 60- and 80-cp. lamps have been eliminated and the 100-cp. lamps have been greatly decreased in number.

Since the department has been organized approximately 150 municipal officials have availed themselves of the company's advisory service, and it is estimated that more than 100 engineering layouts have been submitted recommending new installations and rehabilitating old ones. The features incorporated in the recommendations are usually about the same in all cases.

First, a review is made of the present street-lighting system. The system is reduced to an expression of candle-power or lumens installed and the total annual cost of operation. The cost per lumen is then determined and the average intensity of light on the street is calculated.

Parallel to these figures are set forth the recommendations for an adequate system. The recommended candle-



power or lumens are shown, together with the estimated cost of operation for the proposed installation. This again is reduced to cost per lumen and compared with the existing system. In many cases it has been shown that for an additional expenditure of 30 per cent as high as 400 per cent more light can be supplied on the street.

The distribution of costs is shown. This is a very vital point to bring out, because the fixed costs in equipment to provide street-lighting service remain very nearly the same irrespective of the size of the lamp used. The same pole, wire, crossarm and general maintenance is required for the 800-lumen, 80-cp. lamp as is required for a 10,000-lumen, 1,000-cp. lamp. There will be, of course, some additional special investment for the larger lamp, and probably for transformer and distribution equipment.

It has been the experience of the company that the rate for the 60-cp. lamp consists of 92 per cent for fixed charges and 8 per cent for energy used for illumination.

Advantages of All-Night Street Lighting
250-Cp. Lamp

	Schedule of Burning Dusk to Midnight	Schedule of Burning Dusk to Daylight	Per Cent
Special investment in equipment	96.00	96.00	....
Candle-power-hours of illumination	525,000.00	1,001,000.00	....
Increase	.....	476,000.00	....
Per cent increase	.....	.....	90.6
Revenue	33.48	42.36	....
Increase	.....	8.88	....
Per cent increase	.....	.....	26.5
Operating costs	28.50	34.62	....
Difference between revenue and operating costs	4.98	7.74	....
Ratio of difference to investment, per cent	5.2	.....	8.05
Load factor, per cent	24	.....	46

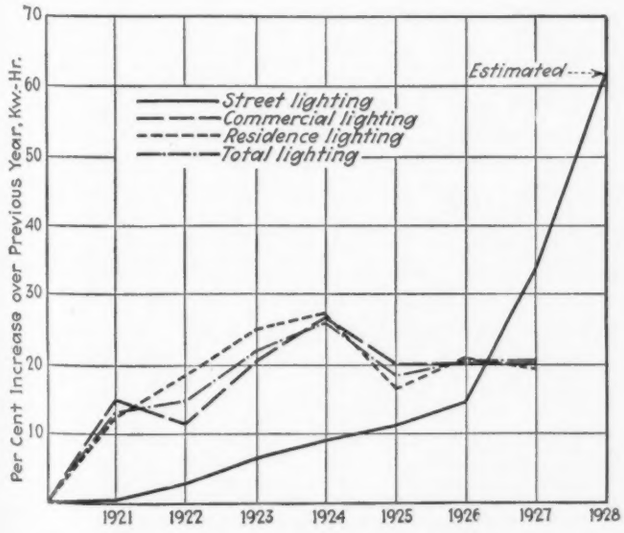
Typical Installations for Which Better Street Lighting Was Sold

Town	Before: No. of Lamps	Before: Average Cp.	Before: Kw.-Hr. Used Monthly	After: No. of Lamps	After: Average Cp.	After: Kw.-Hr. Used Monthly
Arlington Heights	185	50	Gas	335	250	13,634
Lyons	50	400	4,175	170	258	11,850
Oak Park	826	240	25,578	4,004	286	345,230
River Grove	93	60	2,175	100	265	5,678

NOTE—200 per cent increase in street-lighting load from 1923 to 1928.

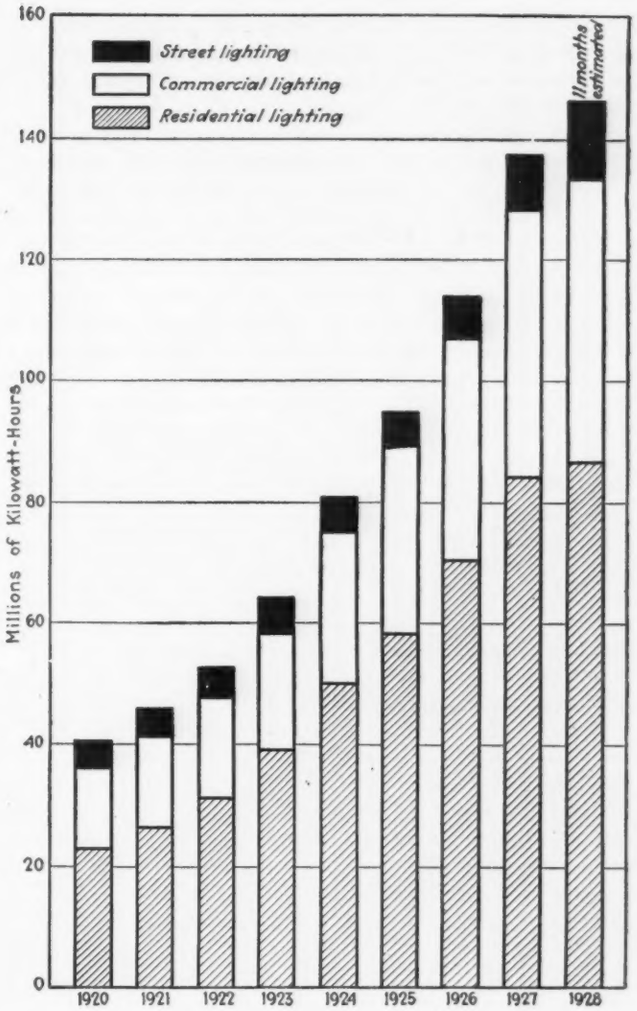
while for the 600-cp. lamp only 37 per cent is for fixed charges and 63 per cent for illumination. The efficiency of the series incandescent lamp also increases as the size of the lamp increases, so that from the customer's standpoint a 250-cp. lamp affords 212 per cent more illumination than an 80-cp. lamp, at an increased cost of only 73 per cent. Likewise, the 400-cp. lamp gives 400 per cent more illumination than the 80-cp. lamp, at an increased cost of only 108 per cent. From the company's standpoint, the investment in equipment for the low candle-power lamp is practically the same as for the higher candle-power lamp, so that the rate of return on investment is 0.8 per cent in the case of the 80-cp. lamp, while it is 9.8 per cent in the case of the 400-cp. lamp.

There is a tendency to request schedules of burning hours, varying from dusk until 10, to 11, to midnight, or to daylight. These irregular burning hours are discouraged. In fact, all burning hours other than dusk



Per cent increases of classes of lighting business

Street lighting, being on a known schedule, may be estimated for 1928, but the heaviest month of 1928 for the other classes may not be so closely approximated and the increase for this year is not shown.



Energy used by classes of lighting business

until daylight are discouraged. Dusk until midnight is considered as 2,000 hours, and on this basis the load factor on a dusk to midnight schedule would be 24 per cent. Dusk to daylight is considered as 4,000 hours, and as a result the load factor is increased to 45.7 per cent. This means, too, that with exactly the same investment and practically the same operating expense the operating income for a 250-cp. lamp has been increased from $33.48 on the midnight schedule to $42.46 on the all-night schedule. The accompanying table shows some of the advantages of an all-night schedule of street lighting.

The elimination of low candle-power lamps is a major function of any street-lighting sales department, and in preparing a plan of street-ligting development it should be borne in mind when they are insisted upon that these low candle-power lamps cannot meet the requirements imposed upon them and sooner or later provisions must be made to eliminate them. It is a policy of the company in all cases that the plan is projected into the future for a period of at least five years and that provisions for expansion are provided for ten or fifteen years in the future.

The efforts to eliminate low candle-power lights are reflected by the fact that the average intensity of all of the street lights served by the company was 175 in 1923, while in 1928 it is estimated that it will exceed 235 cp. While all of this activity has been concentrated on rais-

ing the intensity of existing lamps, it is also interesting to note that the total number of lamps being served on the system has increased from more than 12,000 in 1923 to 30,000 in 1928.

Street lighting, however, has not been the only activity in the lighting field. Commercial lighting has been actively pushed. There has been a definite relation between the street-lighting promotion and the commercial and residential lighting. It has been noticed that where high-intensity street-lighting systems have been installed they are frequently followed by the floodlighting of public buildings or banks, and usually by the installation of higher intensity window lighting. The accompanying chart shows the growth of commercial lighting during the same period that street lighting has been aggressively developed. This is an important thing to consider in the promotion of street lighting because it shows that the character of street lighting in a town is reflected in the character of commercial lighting, and vice versa.

The general lighting organization of the Public Service Company of Northern Illinois has also grown since this sales promotion work was first started, so that today the lighting sales department has four engineers on illuminating engineering work, two men on wiring promotion, three men on street-lighting sales and eight men on district lighting sales. The lighting load of the company has shown an increase of 83 per cent since 1923 and the income from lighting contributes more than 50 per cent of the total income.

Lighting affords the greatest opportunity for increased revenue from existing investment, and in this field the load factor on the dollar can be greatly increased. Central stations which are not taking advantage of this opportunity are neglecting a tremendous potential field of new business.

Rural Electrification in France

SINCE the war great interest has been taken in the electrification of the rural districts of France. The government has realized to the full extent the importance of the work and has not been niggardly in its financial aid and long-term loans granted for this purpose. During the year 1920 subsidies to the amount of 3,500,000 francs were granted; in each succeeding year the amount increased, until in 1927 it was 150,000,000 francs and in 1928 it was further increased to 180,000,000 francs. Long-term loans granted in accordance with the law of August, 1923, total 172,000,000 francs. Combining subsidies and long-term loans, nearly 700,000,000 francs have been granted by the French government, the balance of the total of 2,000,000,000 francs expended on electrification work having been supplied by the various provinces, individuals and companies holding concessions.

At the close of the war only 7,000 districts were supplied with electricity. On December 31, 1927, out of 37,981 rural districts about 21,234 of them were electrified; this represents 55 per cent of the total number of districts with a population of 32,784,365 people, or 80 per cent of the population of France. In 1927 power stations and systems were installed in more than 3,000 districts. M. Tardieu, French Minister of Public Works, apparently was not exaggerating when he made the statement recently that if this present pace of rural electrification was continued, at the end of six years every French village would be adequately supplied with electric energy for home, industrial and commercial use.

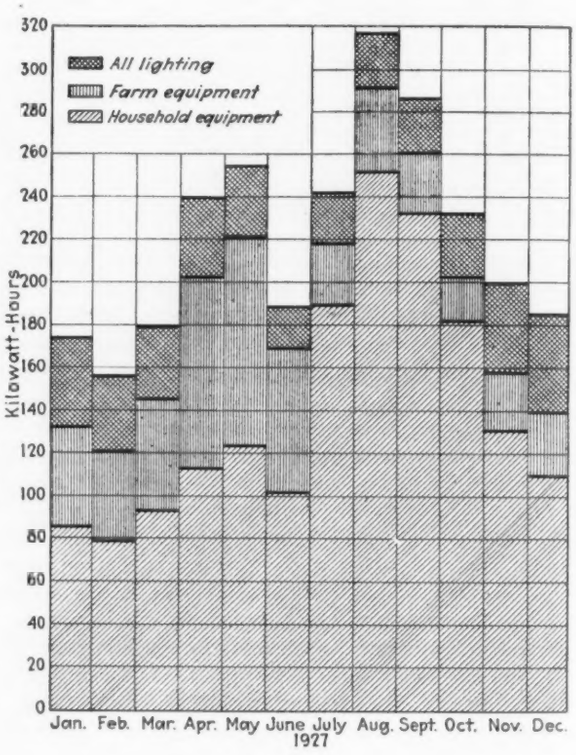
Household Loads Largest on Iowa Farms

By Franklin J. Zink

Iowa Project on Rural Electrification, Garner, Iowa

THE results of study of the Iowa Project on Rural Electrification indicate that the greater portion of energy consumption on the farm will be for household uses. The accompanying chart shows the energy consumption per month of ten farm co-operators during 1927.

Ranges greatly increased the average energy consumption during the months of July, August, September and October. This increased consumption took the place of



Distribution of energy use on ten electrified farms in Iowa

decreasing lighting and farm loads. Ranges and poultry equipment appear to have built up what would ordinarily have been a low consumption period—during the spring and summer months. The poultry equipment consisted mostly of incubators. The incubating load during April, May and June creates the maximum period of energy consumption for farm equipment. Incubators and brooders have very desirable characteristics as load builders, being used continuously when in service.

The equipment used on these ten farms included: Lighting on each farm, ten electric washers, ten laundry irons, ten cream separators, nine ranges and hotplate equipment, eight utility motors (3 and 5 hp. sizes for grinding feed, shelling corn, elevating grain and sawing wood), seven well water pumps, eight soft water pumps, six radio power devices, seven refrigerators, six fans, five milking machines, four toasters, five incubators, five brooders, four utility motors ($\frac{1}{2}$ hp. or less), three radiant heaters and a few other devices, such as heating pads, percolators, grills, etc.

Running Conduits Under Busy Railroad

An unusual method employing jacks was used to install twelve 200-ft. conduits 21 ft. below twelve-track right-of-way in twelve days

By L. R. MADISON
Superintendent of Construction Stevens & Wood, Inc.

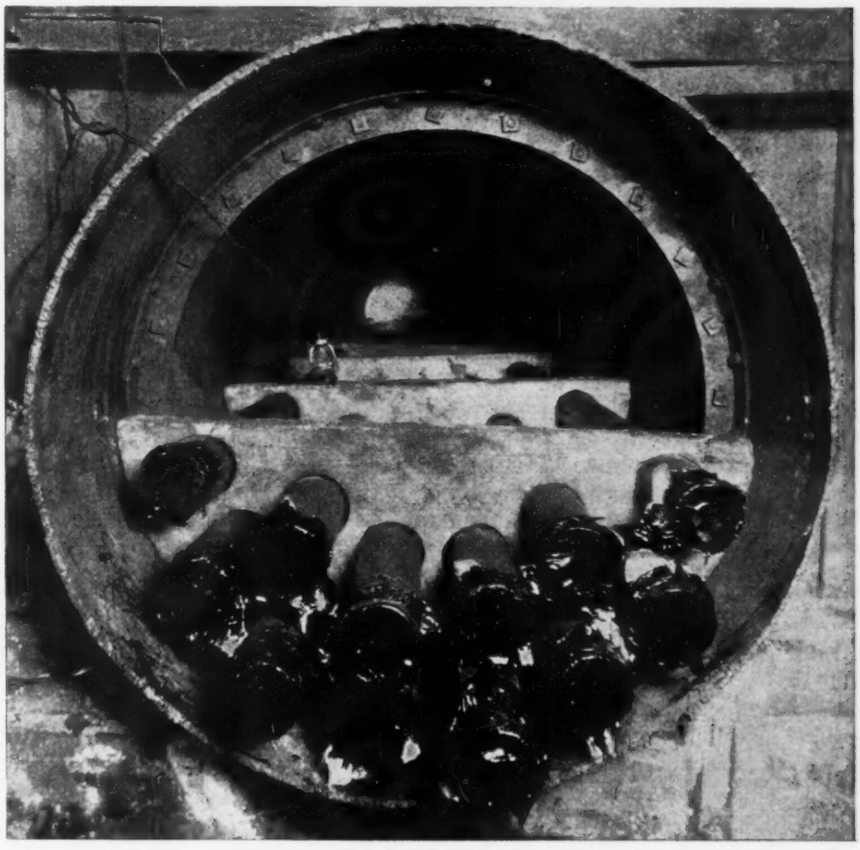
A NEW 20,000-kva. substation had to be built recently by the Pennsylvania-Ohio Power & Light Company in the heart of the business district of Youngstown, compelling the installation of all incoming and outgoing circuits underground. One of the main leads from this substation had to pass under the Erie Railroad Company's right-of-way at a place occupied by twelve tracks. The problem of installing ducts under these tracks without interfering with railroading, yet with reasonable cost and safety, was difficult. An open ditch could not be used because this portion of the Erie trackage is in almost continuous usage and because plans call for lowering the tracks 5 ft. within the next few years. The standard railroad underground crossing agreement calls for a 5-ft. separation between top of rails and top of underlying duct lines, which in this case would have required an excavation about 14 ft. deep. (Owing to foreign obstruction the conduit had to be laid 21 ft. below the rails.) Tunneling appeared to be the only alternative.

An investigation of the soil showed rather loosely packed sand and gravel, which would make ordinary tunneling dangerous and very costly. Therefore it was decided to form the tunnel of a 48-in. diameter steel pipe which could be jacked ahead as the earth was removed from the inside of the pipe. The pipe was made in 8-ft. sections of $\frac{3}{8}$-in. boiler plate rolled to a true circle and butt welded. At the inside of each end and flush with the end of the pipe section a 3x2½x¼-in. angle iron was riveted to serve as stiffener and also as a means of attaching abutting sections of pipe. Each pipe section weighed about 1 ton. The first section of pipe installed, which was used as a shield, was made of $\frac{5}{8}$-in. plate instead of $\frac{3}{8}$ in. and had the angle iron at only one end. The other end was reinforced by welding a ¼x6-in. steel strap in the inner circumference 2 in. from the end of the pipe, so as to allow a cutting edge of 2 in. for driving through the soil.

At one end of the crossing was sunk a 21-ft. shaft to accommodate a manhole and to provide sufficient working space for the jacking operations. This shaft was rigidly timbered on the side away from the railroad and a heavy block of concrete placed against the wall to serve as a bearing block for the jacks.

The first section of pipe was lowered into the shaft by a 1-ton derrick and placed on 12x12-in. timbers cut out to conform to the surface of the pipe. After aligning the first section of the pipe so as to obtain a grade of 1 in. in 40 ft. for drainage, a jacking frame of 12x12 timber was placed against one end and two 25-ton ball-bearing ratchet jacks inserted between it and the concrete bearing block. As the jacks were operated and the pipe section pushed forward the earth from the inside of the pipe was removed by a man stationed inside the pipe. This man also directed the pipe as to line and level by cutting away the earth on the opposite side from that in which the pipe tended to drift. The jacks had a travel of about 13 in., so each time the pipe section moved forward this distance the jacks were backed off and a 12x12-in. timber put in as a filler block.

After the first section of pipe had been forced into the earth a distance of 7 ft. the blocking was removed and a second section of pipe bolted to the first and the jacks brought into play again.



48-in. pipe tunnel 21 ft. below railroad pushed 200 ft. into place with jacks

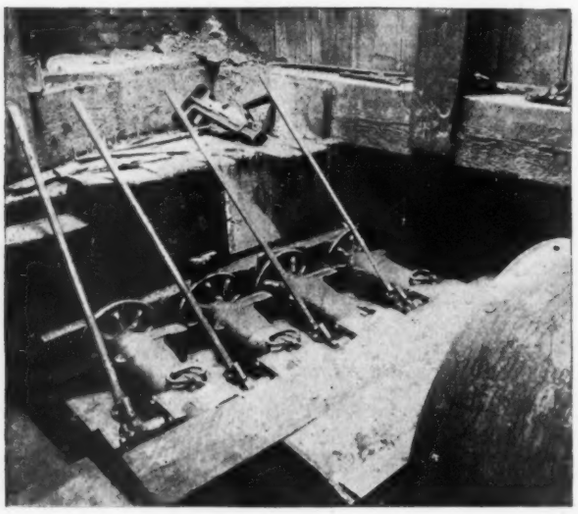
The dirt was removed by a small wooden car running on 2x4 tracks laid in the pipe. When the car was filled at the face it was drawn back to the shaft end of the pipe and the dirt transferred to a bucket.

The same process was repeated until all 25 sections of pipe were in place. Each time a new section was added the run was checked for line and level. As the length of pipe increased, it became necessary to increase the size and number of the jacks. Two 25-ton jacks were adequate to force the pipe the first 50 ft.; two 50's were used for the next 25 ft.; two 70's for the next 25 ft.; two 50's and one 70 for the next 25 ft.; four 50's for the next 70 ft., and four 50's and one 25-ton for the remainder.

To provide men inside the pipe with fresh air an air

hose was used supplied by a small portable compressor. The same hose was used to operate a small jackhammer to cut out or break up boulders which were encountered. Electric lights were also provided in the pipe. No trouble was experienced from water, as all that was encountered was pumped out to a sump in the shaft by a small portable gasoline-driven pump.

On account of the sandy nature of the soil and the vibration caused by the constant passage of trains over-



Jacks used in pushing pipe tunnel under railroad

head the pipe would "freeze" in place if the jacks were not operated for any length of time. Therefore, jacking was carried on continuously day and night until the job was completed. The total time required for installing the 200 ft. of 48-in. pipe, including the time of changing jacks, blocking and adding new sections of pipe, was 290 hours, and the average distance made per hour was $9\frac{3}{4}$ in.

After the pipe was in place an excavation was made to expose the driven end of the pipe. No deviation from line was observed.

Twelve 4-in. socket-joint fiber conduits had to be placed in this pipe tunnel and each was covered with at least 2 in. of concrete. To secure the proper spacing of the conduits, they were supported at 5-ft. intervals by semi-circular precast concrete slabs 3 in. thick. These slabs also served to support the track over which a slide-bottom car was operated for pouring the concrete around the ducts. Pouring of concrete was started in the middle of the pipe and worked toward each end.

The track was allowed to remain in place as the railroad company required the pipe to be filled with earth after the conduits were in place to prevent settling of the railroad tracks above in case the steel pipe should rust out in future years. The backfill had been saved from the original excavation and was put in place by hauling it into the pipe on a small car, shoveling it into place and tamping it in as much as possible. This was the most laborious part of the entire job as there was only 23 in. in which to work between the top of the pipe and the ducts. The ends of the pipe were sealed with brickwork and the conduits carried to the manhole in an open cut.

No evidence of any disturbance to the railroad tracks was observed. Furthermore, there was no interference whatever with operation of the trains. The cost of the job was only about 50 per cent of the cost of tunneling by the ordinary method and the operation was entirely safe both to the men working on the job and to the railroad.

The number of men varied with the number of jacks used, each jack requiring two men. When the "going" was particularly hard, a relay crew of four men was kept standing by to "spell" the men on the jacks. It required 100 full strokes of the jack handles to move the pipe 1 in. after the first 50 ft. had been put in. In addition to the men on the jacks, there were two men inside the pipe cutting away the earth, loading it in the car and pushing the car to the shaft end of the pipe; one man on top to handle the derrick and a foreman on each shift. Ordinary laborers were employed who worked in twelve-hour shifts.

The work was done for the Pennsylvania-Ohio Power & Light Company by Stevens & Wood, Inc., engineers and constructors of New York, under the direction of H. F. Ferguson, district engineer, and L. R. Madison, superintendent of construction.

Sells 5,000,000 Watts in Lamps

SEVEN out of seventeen districts of the Wisconsin Power & Light Company went over their quotas in a recent lamp sales contest in that organization. With 90.8 per cent of its employees in the contest, the company sold 102,061 lamps with a total wattage of 4,980,090. This wattage is not wholly reproduced in added system load but a considerable part of it is, a part sufficient to add appreciably to the annual revenue. The accompanying tabulation, taken from the company publication *Power and Light News*, gives the results of the contest. The ten leaders among the employees had sales ranging from 1,342 to 5,664 lamps.

Report of 1928 Lamp Contest, Wisconsin Power & Light Company

Meters	Quota	Rank	District	No. Employees Selling	No. Lamps Sold	Lamps per Meter	Per Cent of Quota	Per Cent Employee Selling	Total Watts
3,653	6,660	1	Clintonville	71	8,955	2.45	136.20	100	455,473
9,968	17,942	2	Sheboygan	112	23,392	2.33	130.37	100	1,169,161
2,247	4,044	3	Berlin	45	5,093	2.26	125.93	100	256,224
1,184	2,131	4	DeForest	9	2,684	2.26	125.95	100	114,344
7,430	13,374	5	Fond du Lac	178	14,666	2.04	113.39	100	718,130
6,228	11,928	6	Beloit	102	12,893	2.07	108.09	100	598,860
3,388	6,098	7	Ripon	33	6,332	1.86	100.03	100	322,073
2,417	4,350	8	Portage	40	3,962	1.63	91.08	100	198,815
840	1,512	9	Spring Green	6	1,451	1.72	95.96	100	58,485
2,402	4,323	10	Mineral Point	22	3,162	1.31	73.12	100	144,055
902	1,623	11	Belleville	17	1,101	1.22	67.85	100	45,900
2,157	3,882	12	Monroe	25	2,969	1.37	76.48	69.44	132,040
2,338	4,208	13	Tomah	19	2,807	1.20	66.70	76.00	130,275
2,636	6,544	14	Beaver Dam	25	4,930	1.35	75.33	55.55	252,355
2,300	4,140	15	Baraboo	21	2,341	1.01	56.54	87.50	99,230
5,182	9,327	16	Janesville	35	4,772	0.92	51.16	51.47	257,935
1,338	2,408	17	Edgerton	11	551	0.41	22.88	73.33	26,235

Brokers' Loans and

The Credit Situation

Issue and sale of new securities is closely related to the general credit structure. Company executives study money market more closely

By WILLIAM C. CORNWELL
Economist J. S. Bache & Company

THE credit situation has been affected profoundly by the unprecedented rise in brokers' loans in the last two years. In November, 1926, these loans stood at or about the comparatively low figures which they reached after the stock market break of March, 1926. In January of that year they stood at something more than $3,100,000,000, and had fallen by May to $2,400,000,000. In November of the same year they had risen slightly to $2,609,000,000, and after a slow, long rise a total of $3,200,000,000 was reached in September, 1927. It will be remembered that in the latter part of 1927 a recession in business was taking place. This apparently had no effect upon stock market speculation, which grew apace, and brokers' loans increased almost steadily and continually until at the present time they are much above the $5,000,000,000 mark.

W. C. Cornwell

This great increase in brokers' loans has not occurred mainly through accommodations extended to the stock market by banks. The extra funds have been made available by corporations loaning their own funds to Wall Street. The rising rates of interest there attracted this outside money, and it flowed into loans on securities. These funds for loans are being furnished by individuals, firms, corporations, foreign banks and private banks. This outside money in brokers' loans increased from something over $1,500,000,000 in early 1928 to over $3,200,000,000 at the beginning of this year.

Corporations in the past have frequently loaned company funds on the Stock Exchange, but it has never happened before that so vast an amount has been so employed.

It is interesting to inquire why at the present time such a great amount of cash is in the hands of corporations. The answer is that a large expansion of bank credit in the last several years has been created by excess of gold and by the easy money policies of the Federal Reserve Bank. Business did not need this new bank credit, and it found uses in loans on real estate mortgages, loans on installment paper, purchases of bonds, and most, perhaps, of all, in loans against securities.

This latter made possible the issuance of new securities and a large number of corporations put out an immense amount of securities. With the proceeds of sale of these they paid off their bank loans and other liabilities, besides accumulating a great amount of cash on deposit. The high interest rates in Wall Street attracted these funds and they steadily built up brokers' loans to the present high levels. During the last two years more than ten billions of new securities have been issued. Of these securities, three and one-half billions were stocks and the remainder bonds and notes.

It has been said in defense of the great increase in brokers' loans that much of these represent the purchase of new corporation issues by the public, which thus has furnished the corporations with funds which they would otherwise have had to borrow from banks as heretofore. The corporations have therefore been able to provide themselves with new cash facilities based upon sale of their stocks (stocks having no due date), instead of obligating themselves on bank loans which would have to be paid when they came due.

Whatever may be the later effects upon business generally of a high money market if continued for a prolonged period, all conclusions, so far as obtainable, seem to show that up to the present time no bad effects have followed. This, of course, is due to the fact that the bankers, including the Federal Reserve, have made it their business to see that commercial interests have been and are fully supplied with funds at reasonable rates, and that while Wall Street has been carrying the burden of unusually heavy charges for use of credit in its vigorous speculations, this has not diverted funds appreciably from business uses. Commercial loans reached their high in December and have since eased off. There was no ruction and business has been all along able to obtain loans as in other years.

The Federal Reserve Bank's position is not strained, and in fact has not been strained in the last five years, during which the bull market has been operating and business has been more or less active. The Federal Re-

serve Banks' reserves have been normally maintained practically through the whole period. Minimum reserve requirements are now even a little less than in 1924.

The United States held at the end of 1924 $4,500,000,000 in gold—half the world total supply—and, according to Professor Kemmerer in a statement at the time, a release of $2,000,000,000 could have taken place without danger to the gold standard. Since that date our gold stock has been reduced only about $350,000,000, leaving a surplus still of $1,650,000,000, and during that period a number of the most important nations have restored the gold standard, from which it may be inferred that the demand for gold for such purposes should not be excessive in the future. The Boston News Bureau, in a recent editorial, said: "There is quite another reason for high money rates. It is not a reflection of real money scarcity. It is, as Secretary Mellon has publicly stated, an effort to stop the rise in security prices. But not speculation or anything else has materially reduced our great surplus. Credit expansion, of course, has been of impressive proportions, but this expansion has come almost wholly out of the resources of commercial banks."

The president of the Stock Exchange has said that it is not so much a question of how high brokers' loans may go as of the market's trying to do too much in too short a space of time. To catch its breath after too fast a run upward, that vague entity known as the Market has to stop and have reactions and readjustments in order to get wind to start again. But it is to be noted that such temporary halts and reversals are not indicative of any real malady or heart failure. There will probably be a number of them this year—possibly severe ones. When they come they seem to have all the signs of real stoppage and of serious declining trend. Recovery, however, will follow in a longer or shorter period, depending upon technical conditions.

The Chance of Market Reactions

As to how long outside money, which is the backbone of the present speculation, will remain in use for loans to brokers, it may be safely concluded that the owners of a considerable amount of the funds so loaned are waiting for lower prices of securities in order to buy them.

Radically lower prices can only materialize through a great break in the stock market, caused by some event, at present unforeseen, which would forecast disastrous consequences. There is, as has been said, nothing in sight of this character, consequently the chance for purchase of reliable stocks at lower prices depends upon intermediate reactions due to technical causes. In all probability, as has been said, these will come from time to time—some of them possibly severe reactions. On such reactions purchase of good securities with part of the funds now being loaned to Wall Street would reduce brokers' loans, and the securities themselves would be paid for in full and pass into strong ownership. This would, of course, tend to produce a better credit situation.

In the meantime, the policy of the Federal Reserve Bank, since speculation became rampant, has been to hold a steady rein on credit, avoiding drastic action, and applying a continuous pressure against unrestrained and prodigal use of funds. This undoubtedly has tended to neutralize the fever.

Possibly wise action of this character, persisted in, may bring about abatement of high temperature in a natural way. Optimism on the country's future is widespread and is based on actually sound foundations.

Recording Instruments Save Money for Industries

By H. S. Edgerly
Switchgear Department, General Electric Company

FOR many years the use of recording instruments has been limited to utility generating stations where it was desired to obtain a continuous record of those factors that would be of interest to the management. More and more is there an increase in quantity production in industry. With quantity production comes the necessity of studying in detail the various factors contributing to the manufacturing organization.

Especially is this true when quantity production inevitably means profits small in percentage. Detailed analysis is almost imperative to prevent these losses.

By installing recording instruments in the power circuits that feed a plant the management can obtain a record that will show how much time is wasted. On individual units of equipment the record shows idle time or details of operating cycles. In the case of inter-related equipment recording instruments determine whether each part is performing properly in relation to each other part. The peak load of an industrial plant that purchases its power may be largely instrumental in determining the cost of the power. A recording instrument in the circuit feeding such an industrial plant would draw a graphic picture of the power fluctuations.

Opportunities for Grouping Meters

Centralized measuring of energy has become a common practice and, with a recording instrument installed, the total activities of the department are graphically shown. The major machines should also be similarly equipped, for a large machine tool investment when idle or improperly utilized wastes money. Recording instruments leave a permanent record of operation that cannot be refuted. They remove the human element in obtaining the record for analysis and do more than can possibly be accomplished with strictly human agencies.

By installing zero-center wattmeters in buildings having several elevators it is very easy to determine whether or not all elevators are operating to capacity. For steel mills a record can be obtained showing how many times the mill was idle, and subsequent investigation will disclose the cause from which a remedy can be made for the future. The instruments have even been used successfully to check machines being operated on a piece-work basis.

Almost every one connected with industry realizes the importance of maintaining a graphic picture to show progress in production, volume of output, etc., because curves can be visualized much quicker than a corresponding list of figures. The same argument holds true of records of detailed operations, and recording instruments furnish these records automatically.

Trade requirements for recording instruments are also changing. With panel space at a premium the central stations are continually insisting on smaller devices without sacrificing electrical performance. For industry, cost is a vital factor, as it would not be profitable to invest a large sum of money for a device to check operations when several months, or possibly years, would be required to liquidate the investment by the savings that might accrue through its use. The instrument must be so designed that it can be maintained and operated by an unskilled attendant if it is to be of value in industrial work.

Letters from Our Readers

The Awakening of Egypt

To the Editor of the ELECTRICAL WORLD:

The London *Daily Telegraph* recently disclosed the general scheme of a proposal advanced by Dr. John Ball to the Cairo (Egypt) Scientific Society. Doctor Ball proposes to take advantage of the fact that the Quattara depression in the Libyan desert is 165 ft. below the level of the Mediterranean Sea. Water brought from the Mediterranean would form a lake with an area of 25,000,000 acres, which, evaporating at the rate of 36,000,000 tons per day, would permit a continuous hydro-electric output of 116,000 hp. That would be the alarm clock of Egypt's awakening.

The fellaheen of Egypt's sands
Will see the labor of their hands
Enormously increase
When factories by hundred scores,
Where now the lonely lion roars
In undisturbèd peace,
Shall rear their useful roofs and walls
In place of Pharaoh's crumbled halls,
And idleness shall cease.

The sphinx will stare in wild amaze
At marvels laid before its gaze,
By industry's command,
When Copt and Cairene leave their hovels,
Grab up picks and spades and shovels
And, digging in the sand,
Shall turn the Mediterranean flood
To industry's life-giving blood
In Libya's land.

HERODOTUS.

Chicago, Ill.

Inducing Greater Use of Service

To the Editor of the ELECTRICAL WORLD:

N. M. Argabrite's address at a recent meeting of the Public Utilities Association of Virginia, excerpts from which were published in your January 19 issue, appeals to the writer as a very clear and forcible presentation of most of the "Factors that Affect Rates."

Mr. Argabrite pointed out that many consumers are being served at less than cost where consumer costs and load factors are not given due weight in rates. He suggests the way to help correct such inadequacy in rates, but did not mention a method of procedure in putting the way into practice which has been proved a great aid not only in selling the idea that service, not kilowatt-hours alone, is furnished by the utilities, but also familiarizing the public and consumers with forms of rates that more nearly eliminate discrimination.

To persuade consumers to install more appliances and use more kilowatt-hours it is worth while to offer some kind of an inducement rate. Instead of making such inducement rates by providing lower blocks or shorter turning points to those existing rates which ignore or inadequately recognize the consumer charge and load factor some companies offer optional inducement rates presented in such a form as to embody a definite consumer charge for all services, a definite demand charge and consumption charge for commercial lighting and power service and a definite demand and consumption charge—or an equivalent charge covered indirectly in such block kilowatt-hour rates as will approximately weigh load factor—for residence services.

By offering optional inducement rates in such a form, but higher than need be, were all consumers served on the same form of rate, and by letting consumers who elect service under such optional rates understand that the rates could be lower if all consumers were served under the same form of rate, every optional rate consumer becomes a salesman to help sell others the idea of service and not kilowatt-hours alone and also the idea that they are paying not only their own costs but part of the cost of the service to others. It is conceivable that when a majority of the consumers may be served on such higher than need be optional rates an irresistible demand will arise to force a reduction in the optional rates and at the same time make the reduced rates the exclusive rates for all consumers.

W. J. GREENE,
Rate Engineer.

Iowa Railway & Light Corporation,
Cedar Rapids, Iowa

Regulation of Submetering Companies Not the Solution

To the Editor of the ELECTRICAL WORLD:

I am of the opinion that the practice of sales by utility companies of electric service in quantity to be resold at retail rates or by submetering companies is decidedly not to the best interests of the public or of the industry.

Where electrical energy is sold by landlords or submetering companies the ultimate user has no protection as to rates, service or accuracy of billing, and he is often deprived of benefits which are enjoyed by the customers of a utility incident to the development of the industry. Properly managed utility companies strive to give the best possible service at the lowest possible rate, and this can best be done where the utility serves all the customers irrespective of size.

Regulation by governmental agencies of landlords and submetering companies is a step in the wrong direction. Such regulation would lead to endless confusion, and I believe the commissions should not tolerate the practice obtained in New York and elsewhere in connection with submetering, as reported in ELECTRICAL WORLD for December 22, 1928.

In the Pacific Northwest there are few, if any, submetering companies and the power companies deal directly with all the users of electric service.

R. M. BOYKIN,
Manager.

Puget Sound Power & Light Company,
Seattle, Wash.

Checks Within 1-2/3 per Cent

To the Editor of the ELECTRICAL WORLD:

I think you are to be congratulated on the accuracy and the closeness with which you estimated the meters in this state. My figures show 386,000 domestic meters and you estimate 392,000. That is so close that, to my mind, the difference is negligible. It is remarkable how close your estimate runs to the actual figures as I have added them.

I do not know why all the N.E.L.A. secretaries should not get this material up by states. Certainly it is of great value to the sales organization.

JOHN W. LAPHAM.

Minneapolis, Minn.

Customers, by states, are given on page 30 of the Statistical Issue, January 5.—EDITOR.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

A General Steam Equation.—R. C. H. HECK.—It is highly desirable that the properties or co-ordinates of steam shall, if possible, be formulated and related by correct general equations of unrestricted range. Whether such equations can be established is a part of the fixed problem of formulating all gaseous substances. The purpose of this paper is to make a showing of the status of that problem in the form of a graphic exhibit as to what can be accomplished with special types of pressure-volume-temperature equation. The substance chosen for the study is CO_2 because of the relatively wide range of measurement of the properties as consistently laid out in the graphical formulation of his own results by Amagat.—*Mechanical Engineering*, February, 1929.

A Large Hydro-Electric Scheme.—G. A. DE MESTRAL.—The consumption of electrical energy for household and industrial purposes is increasing rapidly in Switzerland from year to year, and from the point of view of national economy it is clear that falling water is the source on which the country must rely for its supply of power. Neither coal nor oil is to be found in the soil and every ton of coal has to be purchased abroad, hence the government railways and industries have turned their attention increasingly to the production of hydro-electric energy on a large scale. The construction of large reservoirs or artificial lakes in the mountains to retain the summer supply of water for use at the power stations during the winter has become imperative in order that the constant flow of power may be maintained throughout the winter months as well as the summer. The Grimsel project along these lines is claimed to incorporate one of the largest and most elevated structures in the world.—*Electrical Review (England)*, January 25, 1929.

Generation, Control, Switching and Protection

The Operation of Rotary Converters.—WALLACE FORD.—An analytical study of the causes of flashover and a résumé of the chief methods adopted in practice to minimize the danger of flashover. The main cause of flashover at the commutator is the unstable voltage distribution around the commutator which is brought about by sudden and oscillatory changes in the armature magneto-motive force and any arcing which starts at the trailing edges of the brushes when the voltage between adjacent commutator segments exceeds a critical value is assisted to spread by the movement of the commutator and by any accumulation of ionized gases between the brush arms. An analytical study of the action of the rotary converter when the load is suddenly thrown on shows the root causes of flashover. It reveals the conditions which produce the unstable commutator conditions. Methods of dealing with flashover suggested are by installing high-speed circuit breakers on the a.c. side or by using flash barriers between the brush arms so designed as to prevent an arc spreading around the commutator after it has started at the brushes.—*Electrical Review (England)*, January 4, 1929.

The Construction of the "Grid" Transmission System in Great Britain.—JOHNSTONE WRIGHT and C. W. MARSHALL.—An outline of the chief constructional features of the system of high-voltage transmission lines which are being constructed under the provisions of the 1926 electricity act. It shows generally how the British system compares and contrasts with existing transmission systems in other countries. The factors influencing the choice of system, types of conductors, towers, substations, transformers and other constructional parts are explained. The chief difficulties which have been encountered and the steps which have been taken to reduce these to a minimum are indicated. Definite engineering costs are included and are reduced to a kilovolt-ampere basis to provide a guide to the present economic position of high-voltage transmission systems in Great Britain.—*Report of the Institution of Electrical Engineers (England)*, January, 1929.

Iron-Clad Switchgear.—K. BÜCHNER.—In metropolitan areas, where floor space is costly, substation equipment must be restricted to the smallest possible space without endangering the safety of operation. On the other hand, rough industrial installations, like mines or rolling mills, where special care of electrical equipment cannot always be taken for granted, require a foolproof and rugged apparatus. Both of these demands are perfectly satisfied by the so-called iron-clad station equipment. Originated twenty years ago in England under the name of Reyrolle gear, it gradually found application all over the world on account of its many undeniable safety features. A large German concern has recently modernized this type of switchgear and has now a number of them installed with a perfect performance record. Cable end-bells and buses are inclosed in stationary cast-iron or steel containers, while disconnects, current transformers and oil switches are in similar cubicals, but are so arranged as to enable a withdrawal which automatically disconnects them from the live buses. All electrical live parts are imbedded in a semi-solid compound of high dielectric strength. Mechanical interlocks are provided to prevent withdrawal with closed breakers. The article describes such apparatus for 10,000 volts and 600 amp.—*Siemens Zeitschrift*, December, 1928.

Transmission, Substations and Distribution

A Generalized Analysis of the Triode Valve Equivalent Network.—F. M. COLEBROOK.—An analysis of the variation with the resultant anode circuit load of the input impedance and voltage magnification factor of a triode valve. A new mode of presentation is adopted which enables the total range of variation of these quantities to be represented as finite functions of a variable with a limited range of variation. The most important conclusion is that at very high radio frequencies the voltage magnification factor may appreciably exceed the voltage factor of the valve, this condition being reached for a finite pure inductive load. Under the same conditions, however, the shunt input impedance is very low.—*Journal of the Institution of Electrical Engineers (England)*, January, 1929.

Protective Armatures for Chain Type Insulators.—H. MÜLLER.—Formerly the main attention of the designer of high-voltage insulators was concentrated upon the puncture strength and the mechanical reliability of the ceramic and hardware parts. In more recent years, with greatly increased voltages and station output, the thermal dangers of a flashover across the chain demand increasing attention. Since no material has yet been found capable of withstanding the enormous and localized heat from a standing power arc, various protective means have been advocated to detract the arc, immediately after formation, away from the porcelain parts. The laboratory of a German ceramic concern tested many existing and a few novel protective armatures with low frequency, high frequency and impulse currents. The article relates the results of the tests with photographic evidences. Among the new types are a pair of straight wires, crossing under right angle, and arcing horns combined with a magnetic blow coil.—*Elektrotechnische Zeitschrift*, December 27, 1928.

Units, Measurements and Instruments

Sphere-Gap and Point-Gap Arc-Over Voltage as Determined by Direct Measurement.—JOSEPH S. CARROLL and BRADLEY COZZENS.—A report of some of the work recently completed at Stanford University in which a new method of measuring high voltages, the current passing through a water resistor is recorded on an oscillograph, is described. Over a million volts to ground were

measured with an accuracy believed to be better than 2 per cent. A calibration of the meter sphere gap was determined for voltages up to 1,100 kw. and the arc-over voltages for point gaps were determined for distances up to 30 ft. Point to plane arc-over voltages also were measured. In connection with the determination of the arc-over voltage of the point gaps sphere gaps were also used to determine whether there was any high frequency set up by the heavy corona streamers from the point that could not be recorded by the oscillograph. Tests were also made in connection with the shielding of the water resistors in order to determine what extent capacity currents were causing error.—*Journal of the American Institute of Electrical Engineers*, December, 1928.

Time Lag of Spark Gaps (Part III).—Y. TORIYAMA.—A description of the method of measurement of impulse ratio of various kinds of spark gaps. The maximum value of breakdown voltage of a spark gap is measured by using surface-charge figures on an ebonite plate. As the equal impulse voltage is always used, the time lag is larger the larger the impulse ratio. The experimental results agree with those of other authors. The impulse ratio of 1 mm. gap length of sphere electrodes of 5 cm. diameter is about 2.75 in the case of an overvoltage, being five times as large as static breakdown voltage. If the sphere electrodes are illuminated by a quartz lamp from a distance of 12 cm. the impulse ratio reduces to 1.7. The impulse ratio of needle electrodes, needle and sphere electrodes and surface discharge on ebonite or glass plate is an order of 3.5 to 5.5.—*Journal of the Institute of Electrical Engineers of Japan*, December, 1928.

Illumination

Lighting of the Philadelphia Museum of Art.—C. L. BORIE, JR., and WARD HARRISON.—A brief review of the early development of the art museum as an institution and a description of the plan for the Philadelphia Museum in its conception, in its present development and in the provision for future extensions and acquisitions. The lighting of various sections of the museum which have thus far been completed are described in detail.—*Transactions of the Illuminating Engineering Society*, January, 1929.

Mixed Lighting in a Machine Shop.—CYRIL SYLVESTER.—Different operations require different intensities. It is in the interest of economy to provide the necessary amount of illumination. In designing lighting installations the first step is to observe the various operations being carried out in the building. From these observations the light intensities are determined. A conversion table from foot-candles to watts per square foot is given by means of which the wattage of the illumination necessary may be determined. — *Electricity (England)*, January 10, 1929.

Motors and Control

Balancing Heat and Power in Industrial Plants.—R. V. KLEINSCHMIDT.—The fullest possible utilization of by-production power is one of the major power problems of American industry, one that ranks with the economical application of mechanical and electrical power and steam and the efficiency of boiler plants and prime movers. Among the most important factors that determine or affect this heat-power balance are boiler steam pressure and superheat, the pressures and temperatures required by the process, type and characteristics of power generating equipment and the utilization of waste heat.—*Power*, February, 5, 1929.

Hamilton Uses New Electric Foundry Process for Cast-Iron Pipe.—The latest contribution of electricity to the foundry trade has been established where a complete new foundry for the exclusive manufacture of "sand spun" cast-iron pressure pipe is approaching completion. When complete and in operation it will not only have the distinction of being electrically operated, but will be the first and only foundry in Canada and the third in the world to manufacture cast-iron pressure pipe by the centrifugal method in sand molds.—*Electrical News (Canada)*, February 1, 1929.

Electrophysics, Electrochemistry and Batteries

The Scattering of a Standing Electromagnetic Wave.—MILDRED ALLEN.—During consideration of the pure Compton effect, the question arose as to what would happen if instead of the running electromagnetic wave the electron were to encounter a standing electromagnetic wave. Would the scattered radiation be the sum of that expected from the two component waves or would the effect be more complicated? An answer to this question has been attempted on the basis of the Schroedinger wave mechanics; it is dealt with essentially from the point of view put forth by Cordon, but in addition the simple perturbation theory given by Klein is shown to yield the same solution, if carried out to its ultimate conclusion. The Schroedinger theory has not yet been developed to the point where it is utterly consistent in telling the whole story of the Compton effect, but in carrying out the computations in connection with the standing electromagnetic wave the author attempted to make the procedure as consistent as possible and still retain the theory as at present developed. The procedure for the simpler case of a running wave may be sketched as follows: The Schroedinger wave equation for an electron in an electromagnetic field is derived by inserting the appropriate Hamiltonian operator in the diffusion equation. A solution is found for this differential equation for the case in which the vector and scalar potentials involved are those of a plane X-ray wave and where the amplitudes of these potentials are assumed so small that terms involving their squares are to be neglected. The constants appearing in this solution are correlated with the energy and momentum of the electron.—*Journal of the Franklin Institute*, January, 1929.

Telegraphy, Telephony, Radio and Signals

Carrier Telephone System for Short Toll Circuits.—H. S. BLACK, M. L. ALMQUIST and L. M. ILGENFRITZ.—A new carrier telephone system designed as a substitute for open wire line construction or circuits of shorter length than could be economically spanned by multi-channel types of carrier systems has been developed. This new system, which is known as type D carrier telephone system, provides one additional talking circuit per pair of wires. The equipment may be adopted to provide facilities quickly and is capable of being moved readily from one location to another when temporary facilities are desired. A novel and original modulation circuit is employed.—*Journal American Institute of Electrical Engineers*, January, 1929.

The Transmission of High-Frequency Current.—C. A. BODDIE and R. C. CURTIS.—The use of high-voltage power lines for carrier current communication presents a number of difficulties not met in the use of simple communication circuits. The authors have indicated how difficulties may be overcome without resorting to complicated transmitting and receiving equipment. The advantages of employing tuned choke coils are described. The latter are used to isolate the communication channel from the remainder of the power system, giving, in effect, a simple communication circuit between stations.—*Journal of American Institute of Electrical Engineers*, January, 1929.

Miscellaneous

Cotton Spindle Oil.—Lubrication of the modern oil-bath spindle is one of the most important items in the economic operation of a textile mill. Lubricating oil is one of the smallest items of purchase because a comparatively small amount is used. From the mill standpoint, the power required to operate the spinning department is more than that required for all other departments combined. Some use oils that are entirely too light in body, with the result that the oils soon become very black in the spindle base, which is caused partially by metal that has worn from both the spindle and the bolster, and by burning due to the high local heating that takes place wherever abrasion exists. Others use oils that are too viscous in body, which oils cause higher power consumption and reduce the speed of the spindles. The safest rule to follow in the selection of oils is to check with the experience with industrial lubrication experts.—*Oil-Power*, January, 1929.

News of the Industry

Madden Muscle Shoals Bill Reported

House Committee Reverses Itself in Effort to Aid American Cyanamid Offer—Niagara Treaty Not Likely to Be Ratified —Colorado River Embargo

By Paul Wooton
Washington Correspondent for the Electrical World

REVERSING the action it took February 8, the military affairs committee of the House of Representatives on February 16 reported favorably on the so-called Madden bill, which proposes to lease the government's Muscle Shoals properties to the Air Nitrates Corporation, a subsidiary of the American Cyanamid Company. As no prior rights are likely to be accorded this legislation, it is expected to die on the House calendar. A report is being written by the minority members of the committee, but it is not available at this writing.

The bill provides for the construction of Dam No. 3 and the Cove Creek dam. The leasing company is to pay 4 per cent interest on the cost of these two dams, less the amount charged to navigation. In the case of Dam No. 3 this is $26,500,000, and it is $20,000,000 for the Cove Creek dam. A like amount is to be paid for the existing dam, No. 2, which is valued at $54,000,000, but from this $10,000,000 will be deducted as chargeable to navigation.

Chester H. Grey, representing the American Farm Bureau Federation, favors the bill reported by the committee and says Muscle Shoals legislation now is progressing along sane and practical lines.

Opposition to the Niagara treaty on the part of Chicago and Lakes-to-Gulf waterway interests apparently will prevent the ratification by this Congress of the agreement with Canada. Senator Deneen of Illinois has requested the foreign relations committee to withhold action on the treaty on the ground that it would be detrimental to the plan of providing a southern outlet from the Great Lakes if any treaty should be negotiated with Canada for increased diversion at Niagara Falls which does not include an understanding as to the diversion at Chicago for navigation purposes. The entire matter of an understanding with Canada in regard to the diversion of boundary waters, Senator Deneen says, should be disposed of once for all in a single treaty.

The resolution restricting the Federal Power Commission from issuing permits on the Colorado River until the Boulder Dam act becomes effective has been reported favorably to the House by the interstate commerce committee. The bill as submitted to the House is identical with the one that passed the Senate January 26 except that a provision was added restricting the embargo to the period of a year.

All of the tributaries of the Colorado are included in the power embargo with the exception of the Gila, and Representative Swing of California made an unsuccessful attempt to have the restriction apply to it also. Some uncertainty still remains as to the effectiveness of the clause of the Boulder Dam act prohibiting the granting of power permits pending the ratification of the project by the states.

Plans are being made for a meeting of the Federal Power Commission next week. This will be the final meeting of the commission as now constituted, since its personnel will change with the incoming Cabinet on March 4. An effort will be made to dispose of as many as possible of the special cases, which include Cumberland Falls.

New Colorado River Conference at Santa Fe

Santa Fe, N. M., was finally, on the invitation of Governor Dillon, selected as the place where another endeavor should be made to patch up an agreement between the three lower Colorado River basin states, California, Arizona and Nevada, over the development of that river and the Boulder Dam enterprise, and on February 14 the conferences began. Utah was also well represented, and Wyoming sent her state engineer to participate. Colorado is less active.

A summary of proceedings wired as the Electrical World goes to press says that the Utah delegates are trying to get the other states to agree to a program of future development sponsored by it. California and Nevada dissent from the inclusion of the Flaming Gorge and Dewey projects as important to flood control, on the ground that this plan would delay work on Boulder Dam, and Arizona insists that the Gila River must not be considered in any treaty with Mexico. California is urging Utah to sign the compact and thus put it in force, while Arizona persists in attacking the validity of the Swing-Johnson bill. William J. Donovan, assistant to the United States Attorney-General, who is present for the federal government, expresses hopefulness of agreement between the contending states.

In the meantime a resolution ratifying the old seven-state compact has been introduced in the Arizona Legislature. This resolution recognizes the Swing-Johnson bill, under which the government would build Boulder Canon Dam, as a valid part of the compact and sets forth that the proposed tristate agreement shall provide only for those allocations of water and power that are provided for in that bill.

The Wyoming Senate has defeated by indefinite postponement the bill proposing withdrawal of that state's ratification of the six-state compact.

Governor Young of California expects an agreement with Arizona's new commissioners to be reached. Only in case of failure, he says in a letter to Governor Dern of Utah, will California turn to the six-state treaty.

In the Utah Legislature a bill to commit that state to the Colorado compact on the basis of six-state ratification, provided seven states have not ratified within six months of the passage of the Boulder Canon Dam act by Congress, has been introduced.

Fire Marshal Blames Explosions on Cable Insulation

A series of manhole explosions which occurred in the shopping district of Boston last week, resulting in injury to more than forty persons, are attributed by Fire Marshal George C. Neal, in part, to the oiled-paper insulation of cables installed by the Boston Edison company, and he has intimated that unless the company can guarantee that further explosions from a similar cause will not occur, the use of such cable will be forbidden. The Fire Marshal's theory is that the heat from the cables generated gas from the mineral oil saturating the paper covering and that the expansion of the gas created a terrific pressure which was the direct cause of the explosion.

A thorough investigation of the source of the explosive gases which caused the damage is now in progress under the fire marshal, with the cooperation of the engineers of the Edison company and Walter L. Wedger, a well-known expert on explosives. The direct-current, three-wire, 115-230-volt cables involved in the accident were insulated for 4,600 volts with oil-impregnated paper cable long used by the company according to standard specifications. The company has informed the fire marshal that it is desirous of going to the bottom of the phenomena which occurred, but so far evidence is insufficient to indicate that oil-insulated paper was a material factor.

In the States' Legislative Mills

Abolishing Commissions and Putting Taxes on Utility Earnings or Output Both Find Advocates—Water-Power Act May Pass in West Virginia

LIKELIHOOD of the passage of a bill to regulate water-power development in West Virginia, upon which, according to some enthusiasts, $100,000,000 will be invested in industries in that state, is reported this week. Nebraska's municipal plants are not all in favor of measures to encourage the small-engine manufacturers in their fight with the central stations. In many other states utility matters occupy much of the legislators' attention.

IOWA.—Organization of rural utilities districts in Iowa would be possible under a bill introduced in both House and Senate. The bill does not permit purchase of generating plants but authorizes purchase or construction and maintenance of distribution systems receiving their power from commercial or other municipal plants, after submitting the proposal to a vote. Twenty-year bonds would be authorized.

KANSAS.—Efforts to nullify the regulatory authority of the Kansas Public Service Commission failed in the House of Representatives last week when a so-called "home rule" amendment to a bill affecting the commission was rejected. The bill as passed provides that appeals made from orders of the state commission shall be taken to the district courts in the counties in which the orders are applicable. Heretofore all appeals taken from commisison orders have gone before the Shawnee County District Court, Topeka, where the commission resides. Another feature of the bill provides that no testimony shall be offered in the courts that has not previously been introduced before the commission. This bill had already passed the Senate.

Other proposed legislation affecting utilities, but failing of passage, included a bill requiring all public service companies to keep separate records for each community served and requiring the submission of such reports periodically to city commissions. This measure also provided for a tax of one-fourth of 1 per cent of the annual gross earnings to be paid to each municipality served.

To Readjust Commission

Separation of the Kansas Public Service Commission from the State Tax Commission would be effected under legislation proposed. A department also would be created for the State Labor Commission. Heretofore the three divisions—regulation, tax and labor—have been combined under the commission.

MISSOURI.—Establishment of a Missouri Water Power Commission is proposed in a bill presented to the House of Representatives by three members. The proposed commission would conduct a survey of Missouri's water-power resources and recommend legislation to develop and conserve them. The Public Service Commission has no jurisdiction over hydro-electric plants unless the energy is to be sold to the public. The proposed power commission would consist of nine members, three to be named by the Governor, three by the President pro tem of the State Senate and three by the Speaker of the House.

Senator Ralph has a bill which would limit the operation of municipally owned water-power and gas plants to the limits of the city in which they are located unless a certificate of convenience and necessity is obtained from the commission. Representative Huber of St. Louis has a bill to abolish the commission and restore to the cities and towns the right to regulate their public service companies.

Municipal League Mistrusted

NEBRASKA. — Attorney - General Sorensen, a political follower of Senator Norris, has called a conference of supporters of the Municipal League legislative program to organize a defense for a set of bills before the Legislature. Representatives of the power companies make the direct charge that the league is merely a stoolpigeon for other interests and that no popular demand exists for the proposed legislation. Strong opposition from several cities with municipal plants and also from groups of citizens is being made against bills to permit municipal plants to serve a 25-mile radius and to allow councils to construct plants to be paid for out of future net earnings without a vote of the people. It is claimed that the bills represent an excursion into unsound economics and are apparently designed to help men who have engines to sell. Arguments made on the other side are that the city plants in many cases cannot effectively compete with transmission-line companies unless they have the same right to expand and that councilmen should have the same power as directors.

The Senate has killed one bill on the league program—one which required payment of cash when municipal utilities are sold.

NEW YORK.—A bill to amend the Public Service Commission law by adding after the word "stock" in provisions affecting exchange of securities in reorganizations or mergers the words "bonds or other evidence of debt" has been introduced by Senator Thayer.

Under a resolution introduced in the Assembly by Langdon W. Post of New York City, the Public Service Commission is requested to advise the Legislature "by what process of reasoning, if any, it has come to fix 8 per cent on capital investment as the proper earning ratio for public utility corporations, and why a 7 per cent return on such investment should not be deemed a fair and reasonable return."

Under the provisions of a Senate bill the period within which electrification of railroads in New York City or an adjoining city must be made would be increased from five years after January 1, 1926, to seven.

OKLAHOMA.—Bills introduced in the House include one changing the annual corporation license tax on utilities from 50 cents on each $1,000 capital stock to 50 cents on each $1,000 assets. Senate bills include one making it a misdemeanor to operate ungrounded any electrical machine likely to interfere with radio reception.

OREGON.—Portland's delegation in the Legislature refuses to sponsor a recommendation of that city that the Public Service Commission laws be amended to authorize municipalities to exercise local jurisdiction over rates, rules and practices of public utilities. The chairman of the Portland representatives explains that they are not assured that their constituents are in favor of such an act. The desire of Portland is to review the rates of the Portland Electric Power Company and the Northwestern Electric Company, despite the fact that the Public Service Commission is prepared to render a new valuation order affecting the rates of both companies.

A resolution introduced directs that space allotted the *Oregon Voter* and its publisher in the lobby of the State Capitol be canceled, it being alleged that the editor is an employee of the electric light and power interests in the state.

TEXAS. — A measure covering changes in rates by public utilities has been introduced by Representative Pope. It provides for a return of 6 per cent and not 10 per cent, as at the present time, and that the basic valuation shall be the "sound value at the time of the trial." In another bill Representative Pope would require every utility company to divulge the names of those who in any way control it, giving the name and address of every holder of securities or creditor of the company.

VERMONT.—Electric power companies of Vermont are opposing a bill before the Legislature which would tax energy generated in the state at the rate of 1 mill a kilowatt-hour, with exemption after payment on 10,000,000 kw.-hr. a year. Representative Goodsell, its author, says such a tax would raise $400,000 a year to meet Vermont's flood obligations. The bill appears to have little support.

Great Things May Hang on Bill

WEST VIRGINIA.—Enactment of the Hugus Senate bill to facilitate hydro-electric development appears to be likely in the closing days of the session, the two groups that have been wrangling over whether transmission of electrical energy out of the state shall be permitted having agreed that the needs of West Virginia industries shall be supplied first and that if there is any surplus it may be transmitted out of West Virginia.

Subject to legislative change, the

salient points of the Hugus bill include a provision that before acting upon applications for license the Public Service Commission shall be authorized to weigh its advantages and disadvantages to the state and its people; that the Governor shall be a member of the commission for the purpose of granting licenses and amending and modifying such licenses; that when there is more than one applicant for a permit, the commission shall grant a license to the applicant it believes "best qualified"; that the commission shall regulate rates and charges and fix and determine prices and manner of sale and distribution; that the term of a license shall not exceed 50 years, subject to extensions of the same length; that a royalty of 1 per cent per annum on gross revenue of hydro-electric companies shall be paid to the state in addition to all other taxes, and that the state shall have the right of recapture under certain conditions. It will be noted that the Hugus bill does not differ very materially from the Keatley and Lilly bills that have been summarized in previous issues of the ELECTRICAL WORLD. Some advocates of water-power legislation think that it will lead to the speedy investment of $100,000,000 in industrial enterprises within the state.

WISCONSIN. — Abolition of the Railroad Commission is asked in a bill presented by Senator Polakowski, Milwaukee Socialist. Assemblyman Loomis of Mauston has introduced a bill empowering municipalities to engage in the electric power business in competition with existing utilities. Mr. Loomis also presented a measure whereby the state would furnish expert engineering and other technical service to cities, towns and villages owning electric systems. The Loomis bill does not go as far as bills introduced by Assemblyman Hanson of River Falls, which completely repeal the indeterminate-permit law and throw the entire utility field open to all competition, both public and private. Much doubt has been expressed as to the constitutionality of the Hanson bills.

Many Themes for Southeastern Men at Jacksonville

A two-day conference of the Southeastern Division, N.E.L.A., was held at Jacksonville, Fla., February 13 and 14 with an attendance of approximately 150, Charles A. Collier, president of the division, presiding. The first day was given over to the rural electrification conference reported last week. The second day was devoted to joint committee meetings of the sections.

In the Engineering Section time was given to matters pertaining to rural-line construction and operation and to the desirability of grounding the neutral. The results of grounding both on operation and on inductive co-ordination were taken up, and sub-committees were appointed to gather data.

The Commercial Section discussed merchandising policies at length, the question of selling by employees bringing forth considerable debate. It was the sense of the meeting that in small properties which would not support a strictly selling organization all employees should participate in sales work, but that in the larger properties merchandising should be handled entirely by the sales force.

Code Procedure Clarified

An important step in clarifying code procedure was taken at a meeting of the electrical committee of the National Fire Protection Association in New York on February 19. A correlating committee of 26 men was appointed with A. R. Small as chairman and V. H. Tousley as secretary. The membership of this committee consists of the chairmen of the nine sections of the electrical committee and of the Article 9 committee.

Under the auspices of the correlating committee work will be started with the 1925 code as a basis to eliminate inconsistencies and to incorporate new material that maintains the principles established in the 1925 code. Under the rules of procedure the correlating committee must reach a unanimous agreement in the development of the revised version of the code. It is thought this procedure will bring prompt action in code work and will eliminate delays because of debates on controversial matters, especially grounding rules.

American Interests Buy Seven British Operating Companies

Acquisition of controlling interest in seven large British operating companies by the Utilities Power & Light Corporation of Chicago, of which H. L. Clarke is president, virtually complete for some months, was formally announced late last week. Control was secured through the Greater London & Counties Trust, Ltd. The Earl of Birkenhead will head the British company as chairman of the board of directors, and it will be entirely manned by British directors and engineers and will buy British plants only.

The Greater London & Counties Trust has among its principal subsidiaries the Bedfordshire, Cambridgeshire & Huntingdonshire Electricity Company, Cookham & District Electricity Corporation, East Anglian Electric Supply Company, Edmundsons Electricity Corporation, Oxford Electric Company, Ltd., Wessex Electricity Company and the Western Electricity Supply Company. These subsidiaries furnish electricity without competition mainly in three large areas not far from London and extending east, west, south and north. The extensions and developments necessary in these areas will require, it is stated, in the next five years a minimum expenditure of more than $50,000,000. The British companies and their subsidiaries serve exclusively 95 cities and towns in England and Scotland, including some manufacturing centers. Their assets are put at $150,000,000.

Purchases and Mergers

New England Power Association Will Take Over Worcester Company on March 15 — Appalachian Electric Power Wants Radford (Va.) Plant

AS FORESHADOWED last week, the Worcester Electric Light Company will join the local properties affiliated with the New England Power Association on March 15, following a close contest for control between that association and the New England Gas & Electric Association, affiliated with the Associated Gas & Electric Company and already controlling the Worcester Gas Light and Cambridge Electric Light companies. The voting trustees of the Worcester company accepted an amended offer of $226 cash per share from the New England Power organization or, at the option of the stockholders, securities in a new company to be formed, details of which will be announced later, according to President Robert W. Rollins of the Worcester property. There are 96,000 shares outstanding, but a one-third interest has been held by the Power Association for some months past.

A cash offer of $275,000 by the Appalachian Electric Power Company for the municipal power plant and electric distribution system of Radford, Va., has been announced by the Mayor of Radford. The Appalachian asks for a "suitable thirty-year franchise" in connection with the offer. The company's offer, contained in a letter from Herbert Markle, manager of the Appalachian's Bluefield division, gives a new aspect to Radford's power situation. As reported in another column, only last week the Radford City Council voted to call a special election to ask approval of a proposal of a bond issue to be used in rebuilding the municipal power dam on Little River and for improvements to the power system and other city utilities. Voting was set for February 26.

The Associated Gas & Electric Company has purchased the Long Lake (N. Y.) Light, Heat & Power Company, whose headquarters are at Deerland, in the Adirondack region.

At a special election Bayport (Minn.) voters declined the offer of the Northern States Power Company to purchase the local electric distribution plant for $60,000. The village purchases its power from the company wholesale.

The Western Public Service Company, Scottsbluff, Neb., has purchased the municipal lighting plants at Oshkosh and Bushnell and privately owned plants at Lisco and Hemingford in that state. It has been asked to make bids for municipal plants at Sidney and Kimball.

An injunction has been granted against the attempt of the city of Nashville, Ga., to revoke the sale of its electric plant to the Southeast Georgia Power Company and take service from the South Georgia Power Company. (See ELECTRICAL WORLD for February 9, page 310.)

The Cargill (Ontario) Electric Light & Power Company, owned by Cargill, Ltd., has been purchased by the Foshay interests of Minneapolis. It is understood that the purchasers will scrap the local plant and link Cargill with other towns near by.

N.E.L.A. Commercial Committees Confer

Electric Water Heating Brings Out Divergent Viewpoints and Much Discussion at Detroit Meeting—Refrigeration, Ranges and Appliance Selling

ELECTRIC water heating, refrigeration, ranges and general appliance selling were discussed at the meetings of the appropriate committees of the Merchandising Bureau, National Commercial Section, N.E.L.A., in Detroit, a week or two ago. From the reports of committee chairmen at the full bureau session on the second day it would appear that this division of the Commercial Section has its problems well in hand, or at least has come to an understanding of these problems that will not long precede their solution.

Electric water heating, according to Norman T. Wilcox, chairman of that committee, is still in a state of evolution. The economics of the business have not yet been reduced to definite figures that will show whether or not the load will be profitable in a particular case. The thoughts of utility men on this subject are yet very divergent and must be brought to some common ground before the industry can effectively take hold of the job of developing this class of load. On some points the session apparently led to meetings of minds. It was agreed that electric water heating could not yet widely compete with gas, that the immediate field of sale was to range customers, and that to reach a satisfactory volume in manufacturing production energy must be sold at such rates as to give a hot-water cost to the customer of $3 to $4 per month.

Among the companies that have already embarked in the water-heating business there are wide differences of opinion in regard to the possibilities of the load and the manner of handling the business. The scale-forming properties of water in some regions apparently make a high-cost copper tank imperative, according to the local company at one place. At another the company does not consider the same water particularly bad. Some companies can see the business only as an off-peak storage proposition requiring special forms of rates, time clocks, switches, multiple-tariff meters, divided heater units and a flock of other limiting conditions and control apparatus. The diversity factor of the load, another utility believes, will permit the use of small-sized water tanks and high-capacity heating units without any consideration of the hours of load occurrence and with a simple "follow-on" rate with a low last step.

Probably the most fruitful source of argument during the meeting was the difference in thought on the relative merits of heaters at the two extremes of high water and low electric capacities and low water and high electric capacities.

Between these extremes were many compromises, all despised by the advocates of both sides. The effect on plant transmission-line and substation capacity is about the same for both types of heater, the higher diversity factor of the larger heating units compensating for the lower demands of the smaller. The diversity of the larger units would not come into play on distribution systems, and their very wide use must require additions to distribution copper and transformer capacity. But this would be no objection; in fact, it must be accepted as a necessary step in the development of domestic load to the immediate "bogey" of 3,000 kw.-hr. per annum. The committee did more than indulge in discussion, however interesting. It arranged for a number of comprehensive surveys of water-heater performance, the first of which will probably be made in Seattle.

The work of the refrigeration committee is not yet ready for public release. A widely embracive plan to awaken and inspire interest in refrigeration is being developed and will be offered to the Commercial Section, possibly at its meeting in March.

On ranges the committee reported progress in the activities already in hand. It recommended that effort be made to bring about wider use of the range plan book published last year, and it fixed upon the contents of the next serial report, which will comprise arguments to executives on the value of the range business, selling points to be used in merchandising reviews of the high points of successful campaigns, and samples of advertising of demonstrated effectiveness.

The general appliance merchandising committee reported that the kilowatt-hour contest was attracting much interest, there being 156 companies entered in it. The standardization of appliances was not accepted by the committee as a function of the national association, but was a matter for each utility to decide for itself. Radio as an approved item of central-station merchandise was accepted by the committee.

Commission Again Asks Holding Company Jurisdiction

The 1928 report of the New York Public Service Commission was filed with Governor Roosevelt and the Legislature on February 15. The commission urges an enlargement of its statutory jurisdiction which will invest it with greater supervisory powers over corporations holding or controlling the stock of utility corporations now under the jurisdiction of the commission. It renews its recommendations that the Public Service Commission law be amended as follows:

1. To require holding companies controlling operating utilities to make and file annual and periodical reports on forms to be prescribed by the commission, including full detail as to property, products or service exchanged between controlled companies and the revenues and expenses relating thereto.

2. To give jurisdiction and authority to the Public Service Commission to investigate the relationship between holding companies and operating utilities, to the end that all of the activities of the holding companies controlling operating companies in the state, including contracts, agreements, etc., may be made a matter of public record.

3. To permit inquiry into the costs and profit accruing to non-utilities from that branch of their business having to do with the furnishing of products or service to operating utilities for ultimate distribution to the consuming public.

The practice of submetering, it is charged in the report, has resulted in a lack of proper protection to users of electricity who receive their supply of electrical energy by purchasing it from the owner of the building. Since the subject of the regulation of submeters is one upon which there is no statutory authorization giving adequate supervisory powers to the commission, the annual report definitely seeks legislation which would grant the necessary authority.

Chamber of Commerce Will Form Water-Power Policy

Various aspects of water-power development will be brought under scrutiny by the national water-power policies committee of the United States Chamber of Commerce, which will hold its second meeting at headquarters on February 27-March 1. The subjects to be considered in detail are:

1. Present status of water-power resources.
2. Facts in regard to ownership of water-power resources.
3. Comparison of hydro-electric and steam power.
4. Rates and rate structure.
5. Facts in regard to regulatory agencies.
6. How state commissions deal with rates.
7. Interstate transmission of hydro-electric power and its transmission.
8. Participation in hydro-electric development by governmental agencies, federal, state and local.
9. Hydro-electric development in relation to agriculture and national defense.

Upon its conclusions regarding these subjects the committee will base recommendations looking to the development for the chamber of a national water-power policy.

At the committee's first meeting O. C. Merrill, executive secretary of the Federal Power Commission, and Colonel William Kelly, vice-president of the Buffalo, Niagara & Eastern Power Corporation, appeared. Mr. Merrill emphasized the desirability of leaving as much of the formulation and administration of policies in the hands of the several states as the states are willing and equipped to undertake. Colonel Kelly stressed the need of a sane public understanding of water-power possibilities.

Power Issues and Politics in Canada

Supreme Court's Ineffective Judgment on Jurisdiction Brings up Specific Issues—Public Ownership Advocated in Quebec—Hydro Rural Service Criticised in Ontario

DISCUSSING the failure of the Supreme Court of Canada to decide definitely whether the Dominion or the provinces own the water powers on navigable rivers, legal experts in Ottawa have suggested that the only way that the question can be decided is for the parties concerned to submit to the Supreme Court concrete cases rather than abstract questions. These concrete cases would have to cover such points as the ownership of water powers on pre-Confederation canals like the Welland; on canals like the Trent, which have been built since Confederation; on the Carillon Canal, which would raise the interprovincial issue; on the international section of the St. Lawrence, which would raise the question of treaty rights, and on schemes like the Beauharnois, wholly in the Province of Quebec, which would decide whether the Dominion or the province has legislative control and jurisdiction. The same legal authorities agree that it would be useless to appeal to the judicial committee of the Privy Council in England, as that body has repeatedly refused to give decisions on hypothetical cases. The whole matter will be given an airing in the Ottawa Parliament.

Public ownership of water powers in the Province of Quebec was urged by William Tremblay, a Conservative member, at a sitting of the Legislature on February 5. Mr. Tremblay declared that it would be better for the province to develop its own water powers than to permit a group of individuals to enrich themselves from the province's natural resources, and he believed the government could accomplish as good results as private interests. Nature had favored Quebec abundantly, in the matter of water power, Mr. Tremblay said, and it was not just that the benefits should go to a group of individuals.

The policy of the Ontario government in regard to rural service from the Hydro lines, particularly the system of individual long-term contracts now imposed on the farmer, was vigorously denounced by the Liberal leader, W. E. N. Sinclair, in the provincial Legislature on February 6. Mr. Sinclair quoted statistics showing that, after seven years of rural extension, there were only 9,759 rural power users. The power they used totaled 13,273 horsepower, or only 1.25 per cent of all the power generated in the province, hamlet dwellers being included. Mr. Sinclair denounced the farm regulations of the commission as rigorous and unreasonable. The farmer, he noted, had to sign an individual long-term contract, which amounted to a lien on his farm, while city people were individually free of such a contract. "I ask this Legislature," he went on, "whether it is fair to impose those terms and conditions on the farmers and for the Hydro Commission to say those are the only conditions on which they can have energy."

Announcement was made by the government at the opening of the Manitoba Legislature on February 11 that proposals will be submitted during the present session for the appointment of a hydro-electric commission and of a survey to report on the most advantageous mode of power development. A plan to bonus transmission-line construction with a view to extending the provincial hydro-electric system to all rural communities which desire it is also to be submitted to the Legislature.

According to a report from St. John, New Brunswick, a New York banking firm has made an offer for the purchase of coal lands in the province with the idea of investing about $2,500,000 in the acquisition of the lands and in establishing a power plant there. It is understood that this offer is contingent upon the company's being able to acquire the present government-owned water-power development in New Brunswick.

Electric Bond & Share Denies Dictation

In Suit Brought by Federal Trade Commission to Compel Testimony, Disavowal that the Company Is Engaged in Interstate Commerce Is Made

BEFORE Judge Knox of the United States Court at New York John W. Davis argued for the Electric Bond & Share Company and Robert Healy for the Federal Trade Commission on February 16 in the suit brought by the latter to compel the company to give testimony and produce records sought in the utility investigation being conducted by the commission.

Mr. Healy, in his argument, explained that the company had refused to give information on the ground that it was not engaged in interstate commerce and therefore not under jurisdiction of the commission. The particular interest of the commission, he explained, was in discovering what the Electric Bond & Share Company received in payments for services to its subsidiaries, which he numbered at more than 150, in 22 states, and whether these payments were legitimate. Mr. Healy maintained that the company retained complete control over these intermediary companies. It was engaged in interstate commerce, he maintained, as evidenced by three of its activities: as general purchasing agent for the various companies, as a clearing house for second-hand equipment and as financial adviser to the companies.

Mr. Davis outlined five arguments against the right of the commission to inspect the records. He said the subpœnas issued by the commission in demanding the records constituted warrants and were contrary to the laws of search and seizure; that the commission sought to exceed its province in the evidence in question; that the company was not engaged in interstate commerce, and that the material demanded, even though the company might be held to be in interstate commerce, included matters that did not pertain to such commerce.

It was explained by the lawyer that the Electric Bond & Share Company was originally organized to take over stock in public utility companies held by the General Electric Company which had been accepted in part payment of equipment furnished by the General Electric Company. For this purpose it had organized holding companies, and its business now, he said, was related solely to these holding companies. It did not, he said, own a share of stock in any public utility company, nor did it engage in the public utility business directly.

Mr. Davis denied that the company dictated policies of the subsidiary companies. Judge Healy said that 413 positions in subsidiaries were held by 42 employees of the company. Mr. Davis said these companies found it to their advantage to have an employee of the parent company as an official, in that they then had a representative in New York, at the center of the business of financing.

Judge Knox gave the commission ten days to file briefs and an additional five days to the company to file answering briefs.

Bitter Cold Hits Utilities Hard in Europe

A cold snap of long duration and unprecedented intensity held the entire Continent of Europe except Spain, southern Italy and parts of the Balkans in its grip all last week, and it was not until Sunday, February 17, that its recession was announced. Great Britain, France, Germany, Austria, Czechoslovakia, Hungary, Poland, northern Italy, Belgium, Holland, Switzerland and other countries are reported in press dispatches to have suffered great hardships, and in all of them utility operations, those especially of the railroad, communication and gas companies, were hampered and in many cases suspended. The augmented demand for coal and the practical difficulty in shipping it was a main factor in the distress, added to the freezing of streams, of gas supplies and of water services.

Little news concerning the effect of the cold snap upon the light and power plants has been cabled and it is probable that they came through best of all the utilities. Threatened cessation of service was, however, reported from several centers of population and industry. On February 15 Breslau, Germany, where

the mercury sank to 22 degrees below zero, was without electricity because of the disablement of its main power station, and the same fate threatened Munich because of an ice dam in the River Wurm, on which the city has a big generating plant that was in danger of being flooded. Apparently, however, it escaped grave damage.

Cities Service Company's 132-Kv. Line Finished

Completion of the standard 132,000-kw. double-circuit steel-tower transmission line, 220 miles long, linking into one system properties extending over Ohio which the Cities Service Company, the Henry L. Doherty organization, has been welding together since 1912, has just been reached. This line crosses the center of the industrial territory of Ohio, and in addition to connecting the generating plants of two Cities Service subsidiaries, the Toledo Edison Company and the Ohio Public Service Company, is tied in at Canton with the system of the Ohio Power Company, at Lorain with the Cleveland Electric Illuminating Company, and at Warren with the Pennsylvania-Ohio Power & Light Company, four separately owned systems being thus interconnected.

Prendergast Says Hostility to Utilities Raises Rates

That needless friction between the public and the utilities which serve them actually raises rates was the contention of William A. Prendergast, chairman New York Public Service Commission, who spoke this week before a Sunday forum in New York City. He said:

In cases in which the public officials have admitted privately that the companies seemed entitled to rate increase, they have fought in the most stubborn and not infrequently ineffective way before commissions against the claims of the utilities. The consequence has been that these cases have had to proceed to a determination with the finding of valuation figures tending to the advantage of the utility and the embarrassment of the municipalities.

In cases where the utilities have objected to the findings of the commissions, they appealed to the courts, which have by their rulings established precepts of valuation which stand as a protection to the utilities in the future. We have, therefore, had an economic battle between utilities and commissions, the net gains of which up to the present time have been on the side of the utilities.

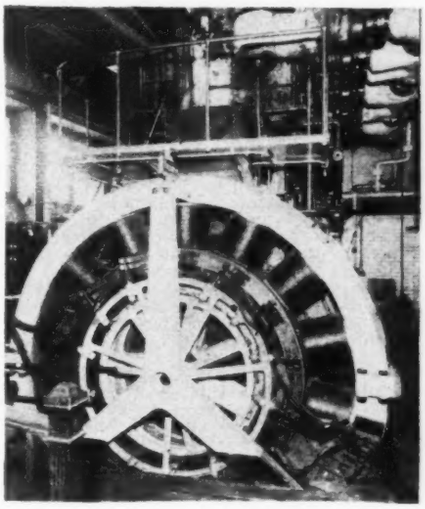
Mr. Prendergast thought this could have been avoided if municipalities had taken a "reasonable and sensible stand," and if public officials had not sacrificed public funds and public time to enhance their own prestige. The public had lost by this policy, he said, because rates had been advanced and valuation principles established by courts in a manner which has measurably strengthened the utilities. He continued:

Perhaps the utilities have taken too aggressive an attitude in the trial of rate cases and should have exhibited a greater disposition not to insist upon their rights under the law, especially with respect to the fixation of a fair rate on their properties. But they have, and this insistence gives us our valuation problem.

Briefer News

FLORIDA CORPORATION COMPLETES NEW PLANT.—A 18,500-kw. steam generating station has been put into operation by the Florida Power Corporation to serve the city of St. Petersburg. It supplants a station which had served the town since 1915.

THIRTY-EIGHT-YEAR-OLD GENERATORS GO TO FORD'S MUSEUM.—An old electrical unit consisting of a steam engine and two 200-kw. generators, which shows an early transition to tall apparatus in order to save space, has been shipped by the New York Edison Company



to Henry Ford for his Museum of American Industries at Dearborn, Mich. This unit, installed in 1891 and the first of its kind ever used in a central generating station, stood 24 ft. above its foundation and weighed 100 tons. Mr. Ford said that it would be used to supply some of the lights in the museum.

LONG FIGHT OVER RATES AT MAUSTON, WIS., ENDS WITH 30 PER CENT SLASH.—Two years' litigation was brought to a close February 14, when the Mauston (Wis.) City Council accepted a rate reduction offered by the Wisconsin Light & Power Company, whose property the city had voted to acquire in an effort to force down electric rates. This proposal, which followed others, involves a reduction of $9,000 a year on a gross income of $30,000 and brings a cut of 30 per cent.

RURAL ELECTRIFICATION COMMITTEE FORMED FOR VIRGINIA.—Plans for a state-wide farm electrification program were formulated February 15 at a conference in the Capitol at Richmond, Va., called by Governor Byrd and attended by about forty representatives of farm organizations, state departments and power companies. John M. McKee of Harrisburg, Pa., secretary of the Pennsylvania Joint Committee on Rural Electrification, explained the plan made effective in that state. It was decided to form a committee of six, three of whom are to be appointed by Governor Byrd and three by the power companies, to draw up a plan for submission to the State Corporation Commission. Under this plan the commission would fix the rate basis.

ANOTHER SALUDA RIVER PLANT?—The Columbia (S. C.) *State* says that a hydro-electric project with 30,000 primary horsepower and a possible development of 50,000 hp. to 75,000 hp. is under contemplation at Lorick's Shoals on the Saluda River, one mile from the city limits of Columbia. The Richland Power Company has been formed by O. Y. Owings of Columbia, owner of the property, and a bill has been introduced in the Legislature to ratify a charter issued to him.

RURAL ELECTRIFICATION A CHIEF SUBJECT FOR NORTHWEST COMMERCIAL MEN.—The annual midwinter conference of the Commercial Section of the Northwest Electric Light and Power Association will be held at Spokane, Wash., February 28 and March 1 and 2. Approximately 150 delegates from Washington, Idaho, Montana, Oregon and Utah are expected to attend. General discussions will take place the first two days, and on March 2 rural electrification will be the topic.

FINANCING AND OPERATING PROBLEMS TO BE DISCUSSED AT OKLAHOMA CITY.—At the eleventh annual convention of the Oklahoma Utilities Association in Oklahoma City, March 12-14, there will be addresses by Martin J. Insull on "Financing Public Utilities" and by Halford Erickson, vice-president Byllesby Engineering & Management Corporation, on "Facts in Relation to Group Operation of Public Utilities." A full program will be ready for the three-day meeting.

SUIT TO STOP SOUTHERN CALIFORNIA SAN JOAQUIN RIVER PROJECTS.—A suit asking $200,000 damages and an injunction against an alleged "threat of the Southern California Edison Corporation to stop the entire flow of waters in the San Joaquin River and its tributaries" has been filed in the Superior Court at Merced, Calif., by the Charles S. Howard Company. The plaintiff contends that riparian rights on property along the San Joaquin River and Mariposa and Deep Sloughs would be violated if a plan of the defendant to construct dams and tunnels above their lands is carried out.

MIDDLE WEST METERMEN GATHER AT CINCINNATI.—Two hundred meter executives of utilities throughout the Middle West attended a meeting at Cincinnati, February 13 and 14, of the meter conference of the East Central

Division, N.E.L.A. M. F. Smalley, Canton, Ohio, presided, and C. S. MacCalla, Youngstown, president of the division, described advances in the past year in meter practice. William Shuler, Dayton, chairman of the Engineering Section, discussed technical improvements; J. R. West, Akron, explained methods to make the largest number of tests a day consistent with accuracy; H. E. Buck, Canton, described the proper application of meters to connected load, and O. K. Coleman, American Gas & Electric Company, New York, spoke on "Instruments of Transmission and Their Proper Application."

EVERETT PLANT NOT OPPOSED.—No opposition to the building of a large steam plant at Everett, Mass., by the Edison Electric Illuminating Company of Boston was in evidence at a hearing February 12 before the Massachusetts Department of Public Utilities upon a modification of the Everett zoning regulations bearing upon building construction. W. H. Cole, superintendent of the street engineering department, Boston Edison company, stated that an investment of more than $10,000,000 in transmission facilities would be saved by locating the new plant at Everett as compared with transmitting energy from the Edgar station at Weymouth to the loads in the north of Boston. A plant of several hundred thousand kilowatts rating is contemplated.

VOTERS FAVOR EAGLE PASS (TEX.) IRRIGATION AND POWER PLAN.—At a recent election held by the land owners of Maverick County (Tex.) Water Improvement District No. 1 bonds in the sum of $1,800,000 were voted, the proceeds to be used for the construction of a hydro-electric plant not far from Eagle Pass. The district had already voted $4,500,000 in bonds for the construction of an irrigation system which will reclaim 60,000 acres of land adjacent to the Rio Grande. The water supply will be taken from the international boundary stream, and the gravity flow will be sufficient not only to irrigate the land but also to operate the hydro-electric plant. It is stated that the electricity generated will be sold to and distributed by the Central Power & Light Company of San Antonio.

APPROACHING AIRPLANE TURNS ON LIGHTS AT LANDING FIELD.—On Monday last the city of Newark, N. J., celebrated the installation of a new lighting system at its airport whereby it is possible for pilots of the mail planes serving the metropolitan area to turn on the boundary and floodlighting system from the air at the airport while the planes are some distance from the field. The sound-sensitive apparatus employed was only recently perfected by engineers of the Westinghouse Electric & Manufacturing Company, and this was its first practical airport application. The air siren and pick-up devices used to turn on the floodlighting system were especially developed for aviation service.

PACIFIC COAST POWER COMPANIES SEE BIG MERCHANDISING MARKET.—A thirty-million-dollar central-station merchandise market for eleven power companies in the three Pacific Coast states was analyzed by power-company executives at the annual convention of the Pacific Division, National Electrical Wholesalers' Association, held at Del Monte, Calif., early this month. Central-station sales policies were explained and 1929 programs reviewed. Prominent representatives of the Great Western Power, Southern California Edison, Portland Electric Power, San Joaquin Light & Power, Puget Sound Power & Light, Los Angeles Gas & Electric, Southern Sierras Power and Pacific Gas & Electric took part. J. S. Kline, president Western Light & Fixture Company, Los Angeles, was elected chairman of the division for the coming year.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for January 5, page 80.]

North Central Electric Association — Commercial Section, Minneapolis, Feb. 25 and 26. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Iowa Section, N.E.L.A.—Operators' Section, Sioux City, Feb. 26-27. H. E. Weeks, Davenport, Iowa.

Northwest Electric Light and Power Association — Commercial Section, Spokane, Wash., Feb. 28 and March 1; Engineering Section, Walla Walla, Wash., March 25-27. Berkeley Snow, 1206 Spalding Bldg., Portland, Ore.

Oklahoma Utilities Association — Huckins Hotel, Oklahoma City, March 12-14. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

Illinois State Electric Association — Springfield, Ill., March 14 and 15. G. W. Schwaner, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

American Society of Mechanical Engineers—Knoxville, Tenn., March 21-23. C. W. Rice, 29 West 39th St., New York.

American Institute of Electrical Engineers—Regional meeting, Cincinnati, March 20-22; regional meeting, Dallas, Tex., May 7-9. F. L. Hutchinson, 33 West 39th St., New York.

Arizona Utilities Association—El Conquistador Hotel, Tucson, April 18-20. Lee C. McCullough, 134 South Central Ave., Phoenix.

Middle West Division, N.E.L.A.—Hotel Fontenelle, Omaha, Neb., April 24-26. T. A. Browne, Lincoln, Neb.

Southwestern Division, N.E.L.A. — Arlington Hotel, Hot Springs, Ark., April 30-May 3. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Southwestern Public Service Association—Hot Springs, Ark., April 30-May 3. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Arkansas Utilities Association — Arlington Hotel, Hot Springs, Ark., April 30-May 3. R. I. Brown, Arkansas Power & Light Co., Little Rock, Ark.

Indiana Electric Light Association — Hotel Gary, Gary, Ind., May 1-3. William Stokes, 1548 Consolidated Bldg., Indianapolis, Ind.

East Central Division, N.E.L.A. — Louisville, Ky., May 7-10. D. L. Gaskill, Greenville, Ohio.

Southeastern Division, N.E.L.A.—Asheville, N. C., May 8-10. C. M. Kilian, 207 Bona Allen Bldg., Atlanta.

National Electrical Manufacturers' Association — The Homestead, Hot Springs, Va., May 20-25. S. N. Clarkson, 420 Lexington Ave., New York.

American Electrochemical Society—Toronto, May 27-29. C. G. Fink, Columbia University, New York.

National Electrical Wholesalers' Association—The Homestead, Hot Springs, Va., May 27-31. E. Donald Tolles, 165 Broadway, New York.

SOUTHWESTERN LIGHT & POWER TRANSMISSION SYSTEM IMPROVEMENTS.—Plans have been made by the Southwestern Light & Power Company to rebuild the 66,000-volt transmission line between Lawton and Manitou, Okla., a distance of 44 miles. Work has been started in Comanche County on a 10-mile high-tension line between Apache and Richards Spur. A 33,000-volt line between Sayre and Erick, giving double protection to Erick, has just been completed for the company. Numerous smaller jobs are under way.

POWER COMPANY TO MAKE INDUSTRIAL SURVEY OF YOUNGSTOWN.—Under the industrial development department of the Penn-Ohio System, steps have been taken for an industrial survey of the Youngstown (Ohio) district. The survey will be conducted by experts headed by Fred W. Hoover, former vice president of the Consumers Power Company. The service rendered will go further than finding new industries. In case an industry is unprosperous, a study of the plant will be made, when requested, and advice given the owners on how to enter some more promising line. The power company will make no charge for the services of the experts.

COMPROMISE REACHED ON OBSTACLES TO TABLE ROCK PROJECT.—The Stone County (Mo.) Court and representatives of the Henry L. Doherty interests on February 15 reached a compromise on the construction of bridges and roads in the Missouri Ozarks district that will be affected by the hydro-electric dam and power plant to be constructed on the White River at Table Rock, 6½ miles from Branson, and application for a federal license will be made at once. State permission had already been granted, subject to adjustment of the local obstacles. Preliminary construction work may start in March. The Empire District Electric Company, Joplin, will distribute power from the plant. Equipment will include four generators rated at 28,000 hp. each. The dam will be 197 ft. high and 1,924 ft. long.

COMPETING APPLICATIONS FOR ROANOKE RIVER SITES HEARD.—Hearings are going on before the State Corporation Commission of Virginia concerning the conflicting applications of the Virginia-Carolina Power Company of Virginia and the Virginia Electric & Power Company and its subsidiary, the Virginia-Carolina Power Company of North Carolina, for hydro-electric sites on the Roanoke River. The company first named wants a license to erect a dam at Boyd's Mill, immediately above the Bugg Island site of the opposing companies. These companies assert that

the applicants for the upper site do not have a market for electrical energy, are not financially able to execute the development and are not engaged in a public service enterprise. The commission's next hearing will be on March 1.

FARM ELECTRIFICATION IN MICHIGAN.—Public demonstrations of practical and experimental labor-saving devices for use on farms provided with electric service were shown to approximately three thousand Michigan farmers and their families this month, during "Farmers' Week," at the Michigan State College, Lansing. Prof. H. J. Gallegher, in charge of farm electrification at the college, told of recent progress, explaining that the two largest power companies operating in Michigan—Detroit Edison and Consumers Power—have both now adopted a definite policy on farm-line extensions, construction and rates. The Consumers Power Company has just filed with the Michigan Public Utilities Commission a new schedule which gives rural customers the same rates as those in effect in cities.

ISSUE OF SCENERY PRESERVATION VERSUS WATER POWER COMES UP IN BRITISH COLUMBIA.—Power rights on Campbell River, one of the most valuable hydro-electric sites in British Columbia, will be sought by five or six separate companies for industrial development, according to information received at Victoria, the capital of that province. The British Columbia Power Corporation, the Crown Willamette Company of Portland, Ore., and the Campbell River Power Company are named as three of the applicants who will be heard by government authorities after March 1. These schemes are said to envisage the ultimate damming of Buttles Lake, within the area of Strathcona Park, and this has created the issue of scenery preservation, opponents of the river's development alleging that it would threaten with destruction one of the finest scenic areas in Canada.

APPALACHIAN ELECTRIC POWER COMPANY SETS ASIDE $11,000,000 FOR ITS PROJECT ON NEW RIVER.—The appropriation of $11,000,000 for the Appalachian Electric Power Company's hydro project on New River, near Radford, Va., is thought to presage speedy development if the company obtains a license from the Federal Power Commission. This 60,000-hp. or 80,000-hp. plant will be by far the largest water-power installation in Virginia. A lake 21 miles long will be formed by the 110-ft. dam. The announcement of the Appalachian's big appropriation followed closely upon action taken by the Radford Town Council in calling for a bond election on February 26, when the voters will be asked to pass upon an expenditure of $175,000 for rebuilding the municipal power dam on Little River and for improvements to the town's power system and other utilities. The city is now using energy supplied by the Appalachian Power Company.

WASHINGTON WATER POWER COMPANY ENLARGING ITS 110-KV. SYSTEM.—Construction will start soon on the 50-mile 110-kv. transmision line that the Washington Water Power Company is to build from Chelan to Stratford, Wash. Surveys are now being completed. This line will be of two-pole "H"-type construction and will probably parallel an existing 110-kv. line between the same points. These lines bring power from the new Chelan power station of the Washington Water Power Company at Stratford. The new line will have a main feeder running south to connect at Taunton, Wash., with the Chicago, Milwaukee & St. Paul electrification.

Recent Court Decisions

NEGLIGENCE OF POWER COMPANY CONTACT WITH WHOSE BROKEN WIRE KILLED CHILD IS FOR JURY.—Baker vs. Kansas Power & Light Company was an action for damages for the death of a six-year-old child who was killed by contact with a broken wire of the company lying in an alley. The insulation on the wire, which had been up for ten or twelve years, was defective. No one knew exactly how the child, who was found dead beside the fallen wire, had been killed. The Supreme Court of Kansas affirmed a verdict for the plaintiff, holding that the question of company negligence was properly submitted to the jurors, notwithstanding that the jurors admitted, in a special finding, that they did not know what caused the wire to break. (272 Pac. 101.)*

COMPANY NOT RESPONSIBLE FOR ACCIDENT DUE TO POLE IT HAD LEFT STANDING FOR CITY'S USE.—In Clinkenbeard vs. City of St. Joseph the plaintiff brought action to recover damages from the city and the St. Joseph Railway, Light, Heat & Power Company for personal injuries alleged to have been suffered by him because of the collision of an automobile which he was driving with an electric light pole within the curb line on a parkway which had carried electric wires of both the company and the city. The evidence showed that in anticipation of the removal of the parkway and the widening of the street the company had removed all of its wires from the pole in question and from other poles within the parkway, but that the pole had not been removed at the time of the accident because the city was still using it to carry wires for its street-lighting system. In affirming the judgment of the trial court in favor of the company, the Missouri Supreme Court said: "Neither do we think that the defendant utility corporation is chargeable with actionable negligence in erecting and maintaining the pole upon the parkway in question. Such pole was erected and maintained with the permission and acquiescence of the city for a necessary public use and service and was being so used by defendant city, according to the uncontradicted evidence, at the time of the accident." (10 S. W. [2d] 54.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

SERVICE CHARGE TO EQUALIZE COST AS REGARDS NON-PROFITABLE CUSTOMERS DISAPPROVED.—Application of the Brooklyn Union Gas Company for permission to charge a general service rate of 95 cents a month for the first 200 cu.ft. or less per meter and 9 cents for each additional 100 cu.ft. has been denied by the New York Public Service Commission by a vote of three to two. The company argued that it had many accounts, comprising nearly 70 per cent of the domestic users, which were non-compensatory under its existing rate. The proposed schedule would effect a more equitable distribution of the cost of manufacture and distribution of gas by promoting a more even load and the cost of service to consumers would be reduced, according to the company's argument. In a dissenting minority memorandum, Chairman Prendergast and Commissioner Van Namee maintained that the present flat rates were "unjust and unduly discriminatory in that customers of convenience are carried at the expense of other customers." These commissioners further said: "The application for service carries with it an implied obligation to at least keep the account compensatory, and a rate structure should be such that this will automatically follow. The existing rate structure does not effect this, so the remedy lies in the distribution of such costs."

TWO KINDS OF SERVICE THROUGH MASTER METERS.—The decision of the New Jersey Board of Public Utility Commissioners against allowing landlords and submetering companies to buy energy at wholesale and resell it to tenants at retail rates was noted under "Commission Rulings" on December 22, 1928 (page 1269). One observation of the commission not then quoted draws a distinction between two kinds of submetering service. It reads: "Questions similar to that now before the board have occasionally arisen in the past and were dealt with according to the conditions surrounding the individual case. The board is of the opinion that it is not against the policy of the state if electrical energy is sold to a landlord through a master meter to be distributed to tenants in a building as part of the services supplied and included in the cost of the rent, and that this is not objectionable. But where the electrical energy is sold to the landlord to be in turn sold and distributed by him as a separate commodity, in quantities measured by the installation of meters at rates to be fixed and determined by him or his agent, it removes from the field of regulation an element of public utility activities which, under the policy of the state, should be subject to regulation. It seems to us that practices of this kind should be regarded as discriminatory and unlawful. . . . In any case where electrical energy is sold to a landlord of a building for resale or redistribution through the medium of meters, and which is not a service charged for in the rent, this should be discontinued. This will be required by the board. The complainant contends that the commission may not interfere with the contractual rights of landlord and tenant. The board does not consider that the contractual relation of landlord and tenant is an issue to be determined. This question is one of rendering safe, adequate and proper service by a public utility in accordance with the statute."

News About Men of the Industry

P. M. Hatch Assumes New Duties in Stamford

Prentice M. Hatch, formerly general manager of the Connecticut Power Company, has just been appointed assistant to the president of the Stamford Gas & Electric Company, Stamford, Conn. Mr. Hatch brings to his new executive position a broad background of experience in central-station

P. M. Hatch

operation obtained through connections with public utility companies in the West Indies, Central America and in various parts of the United States. Following graduation from Tufts College in 1910 he entered the employ of the Trinidad Electric Company in Trinidad, British West Indies, where he worked for two years, returning to the States in the fall of 1912. Subsequent connections followed with the Boston office of Stone & Webster, the Savannah Electric Company and the Ponce Railway & Light Company, Ponce, P. R.

After being discharged from military service he returned to Stone & Webster and served in the southeastern district office until the close of 1920, when he was transferred to the El Paso Electric Railway Company as superintendent of light and power. The next year found Mr. Hatch in Guatemala in the interests of the American International Corporation. It was in 1922 that he was sent to New London, Conn., as superintendent of the Connecticut Power Company, and after Stone & Webster relinquished control of that utility the following year he was made assistant general manager. He had just assumed the duties of general manager at the beginning of this year, when he was named assistant to the president of the Stamford Gas & Electric Company.

DR. ROBERT A. MILLIKAN, executive head of the California Institute of Technology, was made the recipient of one of the two gold medals of the Society of Arts and Sciences at a dinner held February 22 at the Biltmore Hotel, New York. The award was made for his demonstration of the possibility of isolating and measuring the individual electron and his more recent researches in stripped atoms and cosmic rays which have thrown new light upon the foundation of the universe. Prof. Albert A. Michelson was awarded the other medal for his historic experiment on ether drift which opened the way for the development of new conceptions of matter and energy, space and time.

T. J. MCMILLAN has been appointed manager of the Sandstone office of the Minnesota Power & Light Company.

FLOYD L. CARLISLE, chairman of the board of directors of the Northeastern Power Corporation and of the Eastern States Power Corporation, left New York February 13 for a tour of South America. During the trip he will visit Key West, Trinidad, Venezuela, Santo Domingo, Cuba and Porto Rico.

R. D. Cutler New Vice-President in Hartford

Ralph D. Cutler, who was recently appointed vice-president of the Hartford Electric Light Company, entered the employ of that organization in 1907. He was graduated in that year from Yale University in the academic course, and for about eighteen months was in the accounting department, after which he spent about two years in house wiring sales. For fourteen months he was occupied with experimental work on domestic electrical apparatus for the late Austin C. Dunham, formerly president of the company. He then devoted five years to appliance sales, both domestic

R. D. Cutler

and commercial. He was in the U. S. Army during the World War and was appointed sales manager on his return from France in 1919. Mr. Cutler is a director of the Hartford company and has been actively identified with its promotional rate development problems as well as its commercial progress.

E. M. Breed President of Pelton Water Wheel Company

E. M. Breed, for many years associated with the Pelton Water Wheel Company, San Francisco, was advanced to the presidency upon the resignation of Ely C. Hutchinson. Entering the employ of the Canadian Westinghouse Company, Ltd., in 1904, his experience includes two years with that company

E. M. Breed

manager for western Canada for the Allis-Chalmers-Bullock Company and, through an affiliation of that company with the Abner Doble Company of San Francisco, which was absorbed by the Pelton Water Wheel Company in 1911, he became a representative for the Pelton company in western Canada. He became directly associated with the Pelton company in 1915 as sales engineer, later was advanced to the position of assistant sales manager and for five years preceding his election as president was manager of sales. Coincident changes in the personnel of the Pelton company were: Ross L. Mahom, vice-president and general manager; W. M. Moody, vice-president and engineering consultant; H. M. Lee, secretary and treasurer, and C. V. Folds, manager of engineering and operation. All of these men have been associated with the Pelton Water Wheel Company for many years.

EVERETT W. SWEEZEY, formerly general manager of the Stark Electric Railroad Company, has been named vice-president of that company and of the Alliance Power Company. Mr. Sweezey succeeds Howard Morris of New York as vice-president of the two companies. C. E. Sperrow, formerly general manager of the Suburban Light & Power Company, was named general manager of the Stark Electric and the Alliance Power. O. K. Ayers has been named treasurer of the two companies and he will take over the duties which were formerly handled by Mr. Sweezey.

E. C. Hutchinson Goes to the M. W. Kellogg Company

Ely C. Hutchinson, president and general manager of the Pelton Water Wheel Company of San Francisco, has resigned after an association of twenty-one years to become director of engineering for the M. W. Kellogg Company, with headquarters in Jersey City, N. J. During his long connection with the Pelton company he has served as commercial engineer, manager of sales, manager of engineering and sales, and chief engineer.

Throughout his association with Pelton he has been closely identified with

E. C. Hutchinson

hydraulic development in the West and has contributed much to the art through improvements in design of prime movers and governors and the development of record size high-head turbines, both of the reaction and impulse type. In his new position as director of engineering of the Kellogg company Mr. Hutchinson will have complete executive responsibility for engineering in that organization.

H. Hobart Porter, president of the American Water Works & Electric Company, sailed February 15 on the S. S. *Augustus* for a vacation in Europe.

C. M. Taylor has been appointed sales manager of the Lincoln Electric Company, Cleveland, Ohio. Following graduation from Western Reserve University in 1916 Mr. Taylor entered the employ of the Lincoln Electric Company, and shortly thereafter was made foreman of the assembly and test departments. After two years of military service he returned to the Lincoln Electric Company. In 1923 he was promoted to the position of factory manager and in 1925 was elected vice-president of the company. Mr. Taylor remained as factory manager until his present appointment as sales manager.

Lieut.-Col. Max C. Tyler is to be the new chief engineer of the Federal Power Commission. Colonel Tyler has specialized in studies of the electric power situation for a number of years and for a time was in charge of the plant at Muscle Shoals. During the consideration of Muscle Shoals legislation at the last session of Congress he was called to Washington as a special adviser to the chief of engineers on this subject. He has done important work in connection with the study of the power possibilities of the Potomac. Colonel Tyler is expected to take over the engineering work at the Federal Power Commission about August 1, succeeding Major Glenn E. Edgerton, who has been on duty with the Power Commission since 1924.

Obituary

Emile C. Boerner, for several years an electrical engineer with the Solvay Process Company in Syracuse, N. Y., died at his home in Montclair, N. J., February 14. He had been ill for several weeks.

Herbert L. Weckwerth has been appointed superintendent of the municipal electric plant at Kaukauna to succeed J. O. Posson, who died early in December, 1928. Mr. Weckwerth is an electrical engineer and graduate of the University of Wisconsin.

Allan A. Cunningham, Jr., of the Cunningham Electric Company, Nashville, Tenn., and president of Cunningham, Inc., an electrical fixture company, died in that city, February 8, following a brief illness. Mr. Cunningham had been an electrical contractor for the past eleven years. He was at one time president of the local electrical league.

Robert L. Clift, well known in electrical circles in Memphis, Tenn., died January 20, in his forty-fifth year. Mr. Clift operated the Electric Novelty Company in that city. He was a past-president of the Tennessee Electragists and he was also at one time president of the Memphis Electrical Contractors' Association.

George L. Estabrook, secretary and treasurer of the Portland (Oregon) Electric Power Company, died February 14, after an illness of several months. Mr. Estabrook was connected for many years with the banking firm of E. W. Clark & Company and had occupied positions in other utility companies in various parts of the country.

Thomas H. Blakesley, British scientist, died in London, February 14, at the age of 81. Mr. Blakesley was educated at King's College, Oxford. Perhaps his greatest contribution to the electrical industry was his research work resulting in accurate measurement of alternating electric currents. His publications on this subject have been translated into many languages.

Benjamin K. Howard, for the last three years commercial manager of the Texas Power & Light Company and affiliated companies, died recently, after a short illness. Mr. Howard had been in the electrical business practically all his life and had been associated with the Texas Power & Light Company for almost thirteen years. A native of Vermont, he was 48 years old and was well known in Texas and in utility circles throughout the country.

Raphael E. Gallaher, president of the New York Insulated Wire Company, died at his residence in New York, February 10. Mr. Gallaher, who was 78, was a pioneer in the wire and cable industry. In 1884 he organized the New York Insulated Wire Company, which is now a member of the wire and cable section of the National Electrical Manufacturers' Association. He held the position of secretary of his company from the time it was organized until 1927, when he became president.

Henry W. Withers, head of the claim and legal department of the Houston Lighting & Power Company, died at his home in Houston, Tex., February 8. Mr. Withers removed to Houston in 1910 from Fort Worth, Tex., to enter the employ of the Houston Electric Company and remained with that utility until 1923, when he was appointed to the position he held at the time of his death. Mr. Withers was 50 years of age.

J. M. Finch, organizer of the first electric light company in Hornell, formerly vice-president of the Citizens' National Bank and a director in that institution, died at his home in that city on January 20. Mr. Finch in 1885 organized the American Illuminating Company, which later became the Hornell Electric Corporation before it was absorbed by the New York Central Electric Corporation. Mr. Finch was 88 years of age.

F. R. Wheeler, president of the Allied Utility Company, the North Alabama Utilities Company and other public utility organizations, died January 13, after a lengthy illness. Mr. Wheeler was born in Washington, D. C., in 1880 and in the course of his engineering career he organized a number of public utility companies. He was a member of the board of directors of the Washington Board of Trade, the Federal-American Bank, the East Washington Savings Bank and the Washington Wimsett Company. Mr. Wheeler was a member of the American Institute of Electrical Engineers.

Matthew Griswold, who retired as manager of the Erie (Pa.) Works of the General Electric Company on January 1 of this year because of ill health, died at his home in Erie February 10. Mr. Griswold was born in Erie and was graduated from the Sheffield Scientific School, Yale, in 1888. After two years of post-graduate work he obtained the degree of M. E. Upon leaving college he became associated with the Griswold Manufacturing Company, of which he served as president for a number of years. Subsequently he severed his connection with this company to become acting manager of the Erie Works of the General Electric Company, and later he was made manager of the plant. When Mr. Griswold retired as manager of the Erie plant H. L. R. Emmet succeeded him.

Financial and Statistical News

Utilities Showing Normal Increase in Gross

PUBLIC utilities which have already reported on their 1928 operations show an increase in gross revenues ranging from 7 to 10 per cent, which is in line with last year's increase. Operating ratios in virtually all cases have been slightly reduced. The present operating ratio for the utility industry as a whole appears to be around 42 per cent.

Discussing the recent policy of the Federal Reserve Board, the Harvard Economic Society, in a current report, intimates that an advance in rediscount rates would be a natural concomitant of recently adopted policies. The report proceeds:

It cannot be doubted that a drastic reduction of acceptance holdings of the reserve banks, accompanied by some further sales of government securities, would tend strongly to restore to the reserve system the control over the credit situation which it lost last year. In view of the experience of 1928, however, it seems tolerably clear that warning statements and merely temporary reductions in security and acceptance holdings of reserve banks will fail of their purpose, as did the half-way and inconsistent measures adopted last year.

Six New Utility Offerings Made This Week

The largest issue of the week was a $36,000,000 offering of 30-year 5 per cent gold debentures of the Utilities Power & Light Corporation. The sale price was 98 and interest.

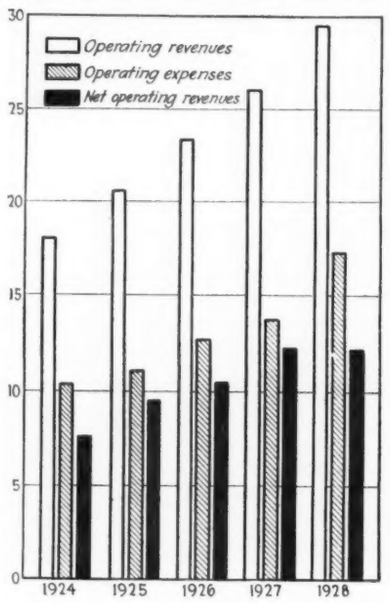
Six per cent gold notes of the East Coast Utilities Company were offered during the week ended Feb. 20 at 99.50 and interest, to yield about 6.60 per cent, the issue involving a total of $1,225,000. The Florida Power Corporation made an offering of first mortgage 5½ per cent gold bonds, series A, at 94 and accrued interest, to yield over 5.87 per cent, an offering amounting to $9,000,000. These bonds, dated Jan. 1, 1929, and maturing Jan. 1, 1979, will be secured by a first mortgage on all of the fixed property of the corporation. Proceeds will be used for refunding the present funded debt of the corporation and for other corporate purposes. The Hydro-Electric Corporation of Virginia issued first mortgage 5 per cent gold bonds, series A, to the amount of $800,000, the price being 95 and accrued interest, yielding over 5.35 per cent.

Two offerings of preferred stock were made. The Seaboard Public Service Company issued 50,000 shares of $6 cumulative preferred stock at $94.50 per share. This company is part of the system of the National Public Service Corporation and, subject to the control of its board of directors, is under the control of the National Electric Power Company. It is a part of the Middle West Utilities System. It will control through stock ownership companies furnishing electric light and power, gas, water and ice services to 509 communities in states along the Atlantic seaboard.

The Central Public Service Corporation issued 40,000 shares of $6 cumulative preferred stock at $95 per share and accrued dividend.

Public Service Company Issues Annual Report

OPERATING revenues of the Public Service Company of Northern Illinois for 1928 were $29,516,269, according to the company's annual report for that year, made public recently. This is an increase of $3,446,203, or 13.2 per cent, over 1927. The amount available for dividends was $5,853,454, of which $3,473,874 was distributed as dividends and $2,379,580 was added to surplus. The company's assets at the end of the year are given by the report as $173,114,827.



Operating revenues up 13 per cent in 1928

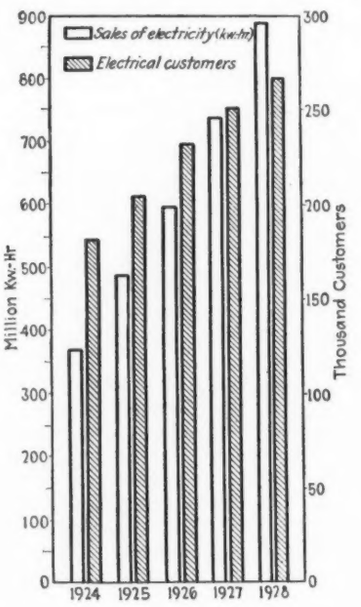
A total of 302 communities are now being served by the company; 299 with electricity, 102 with gas, five with water and four with heat. At the end of the year the company had 416,317 customers, an increase of 27,981 over 1927. Classification of the customers was as follows: Electricity, 268,303; gas, 142,105; water, 4,877; heat, 1,032. During the year the company extended electric service to seventeen new communities and gas service to eight.

Total sales of electricity for the year, expressed in kilowatt-hours, were 893,753,462, an increase of 20.8 per cent over the 739,718,878 kw.-hr. sold in 1927. Exclusive of energy sales to other companies, sales totaled 633,974,183 kw.-hr., an increase of 15.0 per cent over 1927. The total contracted power business for the year amounted to 48,208 hp. Of this total, 57.4 per cent represents new business obtained from new customers and 42.6 per cent represents additional business obtained from existing customers.

In July, 1928, the company completed and placed in service 62 miles of steel tower 132,000-volt transmission line, extending from its Waukegan generating station to its Electric Junction substation, about 3 miles east of Aurora.

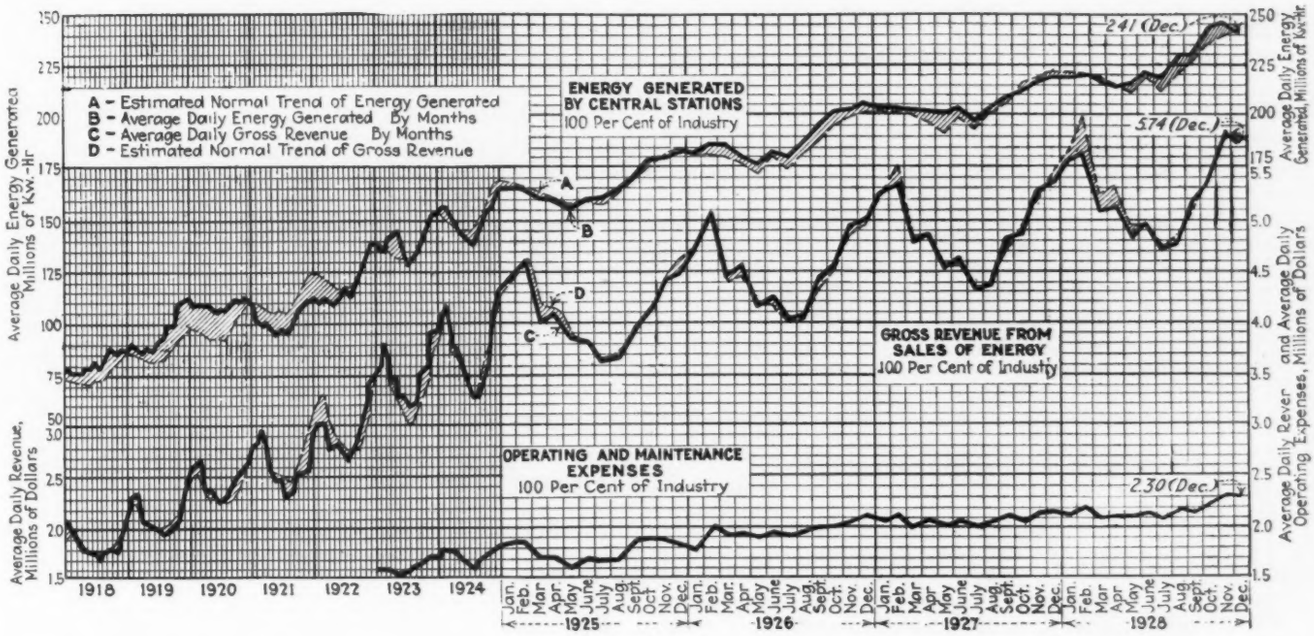
Other important extensions of the lower voltage transmission system made during the year include 36 miles of 33,000-volt lines and 6 miles of 12,000-volt lines. In addition, approximately 266 miles of distribution feeder lines and lateral extensions for rural territory were constructed.

During the year 50 new industries started operations in 31 communities in the company's territory; 37 of these industries moved from communities outside the company's territory. These industries increased the electrical load of the company approximately 7,380 hp. and increased the annual consumption of gas about 16,980,000 cu.ft.



Sales of electricity and rise in customers since 1924

Financial operations during the year


A – Estimated Normal Trend of Energy Generated
B – Average Daily Energy Generated By Months
C – Average Daily Gross Revenue By Months
D – Estimated Normal Trend of Gross Revenue
ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
GROSS REVENUE FROM SALES OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
241 (Dec.)
574 (Dec.)
230 (Dec.)
Average Daily Energy Generated, Millions of Kw.-Hr.
Average Daily Revenue, Millions of Dollars
Average Daily Revenue and Average Daily Operating Expenses, Millions of Dollars
1918 1919 1920 1921 1922 1923 1924
1925 1926 1927 1928

included the offering to the stockholders of 93,550 shares of no-par common stock, 92,453 of which were subscribed for at $100 each through the exercise of stockholders' rights and the remaining 1,097 shares were sold at the market price. The company also issued and sold $10,000,000 in principal amount of first lien and refunding mortgage 4½ per cent gold mortgage bonds, series D, dated November 1, 1928, and maturing November 1, 1978. These were the first bonds ever sold by the company at so low an interest rate.

Operating revenues		$29,516,270
Operating expenses (Including retirement expense $2,100,000)		17,321,698
Net operating revenues		$12,194,572
Other charges:		
Uncollectible bills	$86,249	
Taxes	2,100,000	2,186,249
Net operating income		$10,008,323
Other income		954,028
Gross income		$10,962,351
Deductions from gross income		845,082
		$10,117,269
Interest on funded debt		4,263,815
Available for dividends		$5,853,454
Dividends paid:		
Preferred stock		1,042,506
		$4,810,948
Common stock		2,431,368
Balance carried to surplus		$2,379,580

December Revenue $177,600,000

Increase 7.6 per Cent—Energy Output 7,462,950,000 Kw.-Hr.—9.5 per Cent Over December, 1927 —Entire Increase Is from Fuel

RETURNS for December received by the ELECTRICAL WORLD from electric light and power companies indicate an aggregate operating revenue for the entire industry of $177,600,000, operating and maintenance expenses of $71,400,000 and an energy output of 7,462,950,000 kw.-hr. Each of these items shows an increase over the corresponding month of 1927. The revenue rose 7.6 per cent from $165,100,000, the expenses 5.2 per cent from $67,900,000, the output 9.5 per cent from 6,375,500,000 kw.-hr. Each also showed a seasonal increase over November—the revenue by 1.6 per cent, expenses 3.2 per cent and output 1.2 per cent. The earnings are the highest ever attained; the output was exceeded only once last October.

Regionally, whereas the gains in different sections of the country in November were quite uniformly distributed, in December there was a wider range. New England showed the highest increase compared with November, but compared with December, 1927, it fell somewhat below the national average. This, however, is entirely normal for New England. The Southwest was above the average; other parts of the country were essentially in line with country-wide conditions, with the usual local variations that cannot here be discussed. The changes may be summarized as follows:

Region	Per Cent Increase in Revenue Compared with December, 1927	November, 1928
New England	4.2	3.8
Atlantic	8.1	1.4
North Central	7.7	1.6
South Central	11.0	1.2
Western	6.5	1.2

A comparison of the half year with corresponding periods in former years leads to the conclusion that while there was a continuous rise in revenue and a much greater energy output during the last quarter than in any previous three-month period, nevertheless the culmination of activity really occurred in October or November, if normal seasonal growth is taken into account.

Table I—Central-Station Financial Operations for Four Months in the United States
(100 Per Cent of the Industry)

Month	Total Gross Revenue from Sale of Energy†			Estimated Distribution of Gross Revenue								Total Operating and Maintenance Expenses‡	
				Lighting Customers		Power Customers		Electric Railways		Other Public Utilities			
	1928 Thousands	1927 Thousands	Per Cent Inc.	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands
Sept.	$156,100	$144,400	+8.1	$82,800	$78,200	$57,300	$50,400	$4,600	$4,400	$11,400	$11,400	$65,750	$64,100
Oct.	164,900	150,800	+9.3	89,200	83,100	59,300	51,800	4,800	4,500	11,600	11,400	69,800	65,100
Nov.	174,800	158,200	+10.5	93,900	89,400	63,200	51,800	5,200	4,950	12,500	12,050	69,200	64,300
Dec.	177,600	165,100	+7.6	98,100	93,700	60,900	54,600	5,900	5,100	12,700	11,700	71,400	67,900

† Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡ Do not include interest, taxes, depreciation or sinking fund.

Table II—Generation and Distribution of Central-Station Energy in the United States

(100 Per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly *			Estimated Distribution of Energy Generated										Energy Purchased by Public Utilities for Resale, Kw.-Hr.	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr.			
	1928 †Thousands	1927 Thousands	Per Cent Inc.	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands
Sept...	6,926,974	6,222,002	+11.5	5,701,974	5,121,002	1,367,000	1,274,000	3,869,974	3,410,002	465,000	437,000	1,225,000	1,101,000	1,270,000	1,220,000
Oct...	7,548,704	6,577,566	+14.8	6,216,704	5,413,566	1,470,000	1,372,000	4,241,704	3,565,566	505,000	476,000	1,332,000	1,164,000	1,360,000	1,290,000
Nov...	7,377,298	6,517,713	+13.2	6,077,298	5,365,713	1,500,000	1,400,000	4,067,298	3,487,713	510,000	480,000	1,300,000	1,152,000	1,327,000	1,230,000
Dec...	7,462,950	6,811,347	+ 9.5	6,142,950	5,605,347	1,610,000	1,500,000	3,962,950	3,475,347	570,000	540,000	1,320,000	1,206,000	1,279,000	1,220,000

*Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.
†1928 figures are only approximately comparable with those for 1927, because of changes in classification of certain plants.

*Table III—Operations of Central-Station Hydro and Fuel Plants in the United States**

(100 Per Cent of the Industry)

Month	Energy Generated						Fuel Consumption								
	Hydro Plants			Fuel Power Plants			Coal			Oil			Gas		
	1928 Thousands of Kw.-Hr.	1927 Thousands of Kw.-Hr.	Per Cent Increase	1928 Thousands of Kw.-Hr.	1927 Thousands of Kw.-Hr.	Per Cent Increase	1928 Short Tons	1927 Short Tons	Per Cent Increase	1928 Barrels	1927 Barrels	Per Cent Increase	1928 Thousands of Cubic Feet	1927 Thousands of Cubic Feet	Per Cent Increase
Sept.....	2,711,031	2,191,325	+23.7	4,215,943	4,030,677	+ 4.6	3,134,984	3,183,450	— 1.5	589,175	482,363	+22.2	7,262,261	6,466,951	+12.3
Oct.....	2,795,609	2,350,030	+19.0	4,753,095	4,227,536	+12.4	3,525,730	3,332,729	+5.8	595,568	483,554	+23.2	7,777,704	6,424,859	+21.1
Nov.....	2,717,242	2,466,092	+10.2	4,660,056	4,051,621	+15.0	3,440,267	3,236,107	+6.2	597,803	484,261	+23.5	7,405,950	5,630,302	+31.4
Dec.....	2,686,063	2,697,770	— 0.4	4,776,887	4,113,577	+16.1	3,508,199	3,340,137	+5.0	806,250	624,276	+23.9	7,126,747	4,805,064	+48.4

*As collected by United States Geological Survey. The data are for the electric light and power industry only.

Thus, compared with the same months in 1927, the increase in energy output in September was 11.5 per cent; it rose to 14.8 in October and fell successively to 13.2 and 9.5 per cent. Revenue reached its relative peak a month later, in November, the successive percentages being 8.1, 9.3, 10.5 and 7.6. These movements are, however, thus far nothing more than minor oscillations on a smoothly rising tide. The same conclusions may be drawn from a comparison of actual revenue and energy output with the normal growth curve computed from records of past experience, as shown on the accompanying chart.

Fuel Compensates Lack of Water Power

For several months the output from water power plants has been falling off more or less continuously, each successive month revealing a smaller excess over 1927. To balance this, the output from fuel has increased rapidly. Hydro energy fell from 2,949,089,000 kw.-hr. in August to 2,686,063,000 kw.-hr. in December. Fuel-generated energy increased from 4,178,727,000 kw.-hr. in August to 4,776,887,000 kw.-hr. in December. Earlier in the year there were a number of months when hydro energy output showed gains exceeding 20 per cent for a twelve-month interval. In December this excess had completely vanished, so that there actually was a slight, though negligible, decrease from December, 1927. The opposite happened in the case of fuel plants; their excess in August was 5.4 per cent over August, 1927. In December, when the entire increase had to be carried on thermal plants, their output was 16.1 per cent greater than a year ago.

Fuel consumption was increased to correspond, as appears from Table III. For each kind it was greater in December, 1928, than in December, 1927: Coal 5.0 per cent; oil 23.9 per cent; natural gas 48.4 per cent. In the last-named much of the apparent increase is due to exceptionally low consumption a year ago; compared with November there was no increase; in fact, a decrease of 4 per cent. Much more oil was used, especially in California and to a less extent in Florida.

H. Hobart Porter Predicts Prosperous Year

Before sailing for Europe last week H. Hobart Porter, president of the American Water Works & Electric Company, expressed confidence in the possible achievements of his company during 1929. He said:

"Although our annual report will not be released until next week, I can say that the company will earn in the neighborhood of $3.50 a share on the actual number of shares of common outstanding on December 31 last, comparing with $2.79 a share earned in 1927. Over 70,000 shares of common stock were issued during the year 1928 in stock dividends. Our properties, both electric and water works, showed a substantial increase in customers last year. More than 18,000 water customers and over 16,000 electric customers were added to our lines, making a total gain of over 34,000 for the American Water Works & Electric System.

"Business activity in our territories was well maintained during January and I can foresee no serious let-down for some months. I am reasonably optimistic for the last half of the year and believe that in 1929 our company will show an even better statement."

Pacific Gas & Electric Stockholders Pass 50,000 Mark

Stockholders of the Pacific Gas & Electric Company now exceed 50,000, the exact number being 51,171. That the stock is widely distributed may be seen from the fact that only 1 per cent, or 534 stockholders, own 1,000 shares or more. Twenty per cent, or 10,227, own from 101 to 1,000 shares each; 60.2 per cent, or 30,795, own as few as eleven and not to exceed 100 shares each; 9 per cent, or 4,621, own but six to ten shares each, and 9.8 per cent, or 4,994, have holdings ranging from but one to five shares each. Over 82 per cent, or 41,914 stockholders, live in California.

Central States Edison Company Adds to Directorate.—Floyd W. Woodcock, president of the Empire Public Service Corporation, the holding company recently organized, and J. A. W. Iglehart of Baltimore have been elected directors of the Central States Edison Company, Chicago.

Set-Up of New Vermont Utility Announced.—The proposed outstanding capitalization of the Central Vermont Public Service Corporation, organized from the merger of seven power companies operating in Vermont, has just been announced. The capital is to consist of 30,000 shares of preferred stock, 34,942 shares of common stock and $4,300,000 of bonds. The authorized capitalization is to be 50,000 shares of no-par preferred and 50,000 shares of no-par common. All the Insull properties in Vermont excepting the Twin States Gas & Electric Company are to be included in the merger.

Business News and Market Conditions

Electrical Manufacturing Continues on a High Plane

THAT the electrical manufacturing plants of the country are operating on a plane materially above that at this time last year is indicated by reports received by the ELECTRICAL WORLD on the monthly electrical energy consumption by a large portion of these plants. The rate of production of electrical equipment and supplies during January was about 3 per cent under December, but was 5.3 per cent over January last year. A study of past monthly operations of the electrical manufacturing plants indicates that a material drop in rate of operations is expected at this season of the year, which downward trend will probably extend into April, during which month the low point of operations for the year is generally recorded.

The index of activity in the electrical manufacturing industry, based upon consumption of electrical energy, stands at 131.3 for January, as compared with 124.7 per cent in January last year. Comparative indexes of productive activity referred to the average activity for the period of 1923-25 as 100 and adjusted for number of working days are as follows:

January, 1929	131.3
December, 1928	135.3
November, 1928 (peak month)	146.4
January, 1928	124.7
Average for full year 1928	127.4
Average for full year 1927	119.5

American business and industry as a whole started the year in an excellent manner and generally sound business and industrial conditions continue to prevail throughout the country. The undercurrent of business optimism which was so prevalent at the close of 1928 has been entirely justified by the factual evidences made available during the past six weeks. All the recognized authoritative indexes point to current business and industrial operations above the estimated normal, with but few weak parts in the general economic structure. Far-seeing authorities are now extending the present period of high business and industrial operations to cover at least the first half of the year.

Lead Contiues Active; Price Marked Up

The preponderance of news in the non-ferrous metal markets this week is bullish, with continued strength in lead a feature. Demand for that metal has been excellent and prices have been advanced another ten points. Copper and zinc are unchanged, at 18 cents and 6.35 cents, respectively, but more than twice as much has been sold as was booked in the preceding week.

The copper market has not been active, but the custom smelters, and some others as well, have done a satisfactory business at unchanged prices of 18 cents per pound delivered in the East and 18⅛ cents in the Middle West.

NEW YORK METAL MARKET PRICES

	Feb. 13, 1929 Cents per Pound	Feb. 20, 1929 Cents per Pound
Copper, electrolytic	18	18
Lead, Am. S. & R. price	6.75	6.95
Antimony	9.67	9.66
Nickel, ingot	35	35
Zinc, spot	6.70	6.70
Tin, Straits	49.625	49.125
Aluminum, 99 per cent	24.30	24.30

Base copper wire price Feb. 20, 1929, 19¾ cents.

Electric Industrial Trucks and Tractors

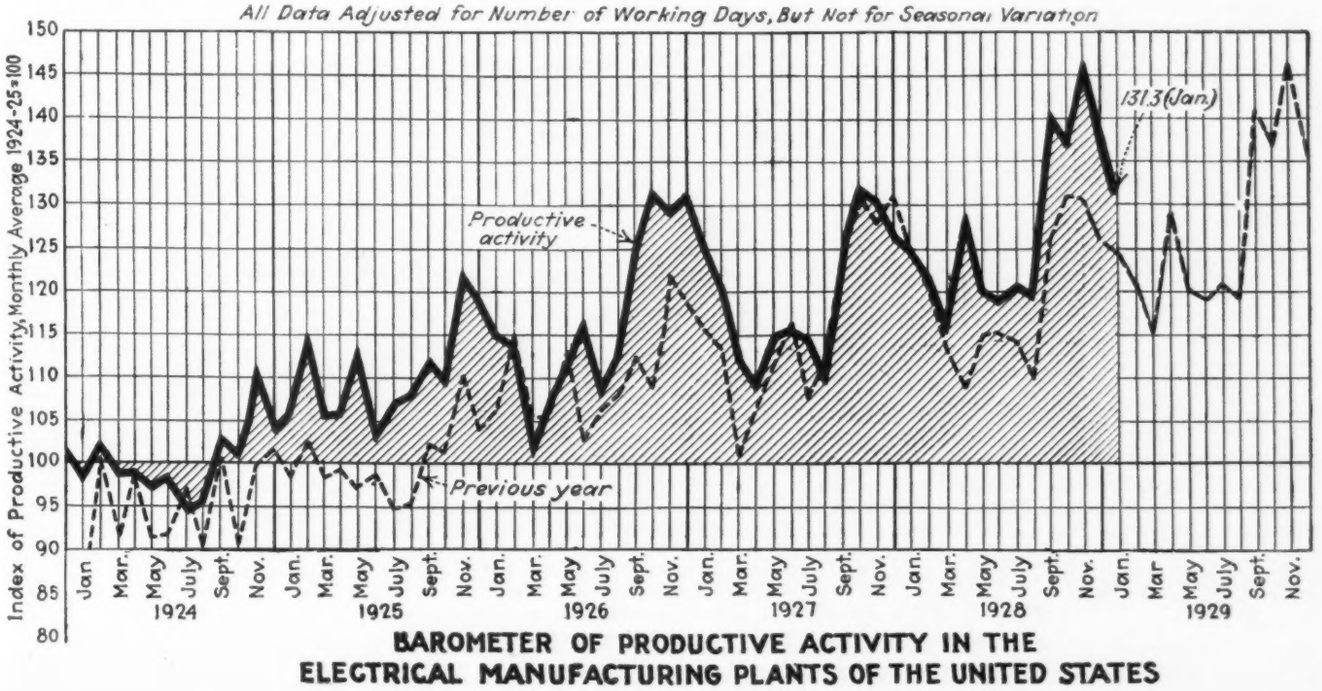
January shipments of electric industrial trucks and tractors, as reported to the Department of Commerce by the ten leading manufacturers in the industry, were 148, as compared with 153 in December and 112 in January, 1928.

Shipments of Electric Industrial Trucks and Tractors

(In number of vehicles)

		—Domestic—		
1928	Total	Tractors	All Other Types	Exports
January	112	5	98	9
February	119	15	86	18
March	129	18	95	16
April	136	9	121	6
May	114	8	93	13
June	116	6	96	14
July	107	5	87	15
August	96	5	85	6
September	118	11	102	5
October	134	5	109	20
November	132	9	117	6
December	*153	10	*126	17
Total (year)	*1,466	*106	1,215	*145
1929				
January	148	4	125	19

* Revised



BAROMETER OF PRODUCTIVE ACTIVITY IN THE ELECTRICAL MANUFACTURING PLANTS OF THE UNITED STATES

Market Conditions

ELECTRICAL business for the first two months of 1929 indicates a record quarter in the Eastern district, and possibly in some of the others. Expansion and betterment programs on the part of the utilities are providing attractive business. Transformers, switchgear apparatus and control equipment are prominent throughout the Eastern district. In the New England area, however, industrial orders dominate this week.

Central-station business in the Southeast is rather lower this week. Plans are under way to rehabilitate certain small independent systems.

Middle West business continues normally active without peaks. The railways and certain branches of industry are furnishing a satisfactory volume. Manufacturers in the St. Louis area have difficulty in keeping on hand sufficient stock of small apparatus to fill orders.

The Pacific Coast area reports the past week a quiet one, but records a large volume of contemplated business. Climatic conditions still impede business in the North.

Quiet Week Recorded on Pacific Coast

The electrical and prospective business on the Pacific Coast is featured by a very quiet week in power company and railroad business and by the activity of certain sections; such as Alturas and vicinity, whence orders have been received for 500 assorted poles of 20 and 25 ft. and wire and hardware. Work will shortly begin on a $3,000,000 lumber plant to tap Western Modoc County and a $500,000 paper mill for Butte County. The proposed federal and state construction in the Bay region covers a $5,000,000 federal building for San Francisco and a $1,000,000 state building for Oakland. Irrigation districts are all actively purchasing, such as 10,000 lb. of weatherproof wire and ¼ carload of pole-line hardware for Modesto, and a carload of 62-in. crossarms for Turlock.

The Imperial Valley district has a $3,000,000 bonding budget, including much electrical work. Other proposed construction includes a $2,000,000 cold storage terminal for San Francisco, a $1,000,000 sanitarium for Chandler, Ariz.; a $150,000 fire alarm system for Glendale, a 40-acre tire plant for Los Angeles, a $1,500,000 shopping center building for Hollywood and proposed bond elections for $1,000,000 to electrify the old California cable line in San Francisco and $2,000,000 for Long Beach schools. Actual ordering is quiet and largely limited to specials, such as three electric welding equipments, one carload of ⅜-in. strand, 200 assorted heavy line pulling grips, one carload of 12-in. pole stubs, all for the Fresno district, and a $15,000 earth-boring machine for pole setting.

Sales volumes along all lines, from heavy apparatus to small domestic appliances, since the latter part of January have been cut in half, due to snow and cold weather in the Puget Sound district. Industrial and central-station buying was exceedingly light and the only order reported that was of any consequence was thirteen motors for a Tacoma woodworking plant. Specifications are being written for machinery and motors for a $300,000 lumber mill in eastern Washington. Bids were opened for the Ruskin hydro-electric project of the Western Power Company, Ltd., at Vancouver, B. C., reported, ranging from $1,500,000 down, and for work involving a dam in connection with a $7,250,000 development. A 50-mile 110,000-volt power line from the Chelan power station to Stratford, Wash., is planned by the Washington Water Power Company. The city of Tacoma has filed an application for water rights on the Nisqually River, announcing that plans are completed for the ultimate generation of 300,000 hp. at a cost of $25,000,000 and the city of Everett, Wash., has filed an application for rights on the Sultan River, announcing plans for the expenditure of $2,200,000. Mount Vernon, Wash., is planning a street-lighting system. The British Columbia Electric Railway Company, Vancouver, B. C., has let a contract for a $40,000 power distribution plant having a capacity of 20,000 kw. Construction projects are as follows:

The Signal Section, Signal Corps, General Depot, San Francisco, will receive bids until March 4 for electrical supplies (Circular 65) and until March 5 for insulators, etc. (Circular 66). The Salinas Valley Ice Company, Salinas, Calif., plans an ice-manufacturing plant at Chualar, Calif., to cost $150,000. Los Angeles, Calif., plans ornamental lighting systems on Selma, Mines and other streets. The Pickering Lumber Company, Kansas City, Mo., plans a mill near Alturas, Calif., to cost $1,500,000. The E. A. Hoffman Candy Company, Los Angeles, plans a factory to cost $100,000. The University of Washington, Seattle, Wash., will build an aeronautics building to cost $290,000. The Kalispell Refining Company, Kalispell, Mont., plans extensions in its plant to cost $100,000. The Royal Milling Company, Great Falls, Mont., plans a flour mill to cost $150,000. The Southern Sierras Power Company, Riverside, Calif., plans an addition to its power substation at Yuma, Ariz., to cost $40,000. The Southwestern Portland Cement Company, Los Angeles, plans a mill near Albuquerque, N. M., to cost $1,250,000. The Christmas Copper Company, Christmas, Ariz., will build a stamping mill to cost $130,000.

Small Apparatus Sales Heavy in St. Louis Area

Manufacturers in the St. Louis district report the sales of small apparatus in such good volume that it is difficult to keep up their stock. Power companies are buying distribution transformers in quantity and industrial sizes of motors are in constant demand and oil companies are buying motors for drilling and pumping. One large producing company has just placed an order for one 200-hp. and one 100-hp. motor with two dozen smaller motors for drilling and pumping. The same company is planning two refineries and pipe line extensions contemplating a total expenditure of $5,000,000 for electrical machinery. A power company in the Southwest has contracted for a 2,000-kw. turbo-generator to cost $55,000 and an industrial company bought a 400-hp. motor for $4,000. Construction projects are as follows:

Tonkawa, Okla., plans extensions in its municipal electric light and power plant to cost $100,000. The Oklahoma Gas & Electric Company, Oklahoma City, Okla., plans extensions in the transmission line at El Reno and vicinity to cost $80,000 and will make extensions in the distributing system at Noble, Okla. The Panhandle Service Company, Buffalo, Okla., plans a transmission line to Rosston, Okla. Dallas, Texas, will receive bids until March 15 for electric generators, generator sets, switchboard and auxiliary equipment. Colorado, Texas, contemplates a flood lighting system and beacon lamps at its proposed municipal airport. The Tyler Milk Products Company, Tyler, Texas, plans a plant to cost $150,000. Beaumont, Texas, plans a flood lighting system and beacon lamps in connection with its municipal airport to cost $100,000.

Overhead Construction Under Way in Middle West

General business in the Middle West district continues satisfactory in most respects. Recent reports of the coal mining sections are encouraging and seem to indicate the return of a large portion of their business recently held by other fields. The railroads continue their purchasing of equipment and car loadings are comparatively high. The utility companies are busy with construction work and, with the milder weather, overhead construction is getting under way in good shape. Some of the interesting orders placed include two 5,000-amp. three-pole, single-throw, vertical, isolated-phase oil circuit breakers, transmission line hardware valued at $30,000, 426 Thompson meters of 5 to 3,000 amp. capacity, 80 current transformers, 250,000 lb. of triple-braid weatherproof wires and cables, construction orders aggregating $150,000 and "Mazda" lamps valued at $150,000. Jobbers' sales are generally satisfactory and considerable municipal business is being obtained, one order in particular for street-lighting equipment

being valued at $28,000. Construction projects are as follows:

The Northern States Power Company, Minneapolis, Minn., plans ten power substations and extensions in transmission lines in the vicinity of Eau Claire, Wis., to cost $350,000. The Chicago, Milwaukee & Pacific Railway Company, Chicago, contemplates an addition to its car repair shops at West Milwaukee, Wis., to cost $50,000. The Peerless Egyptian Cement Company, Port Huron, Mich., will make expansions to cost $100,000. The Detroit Edison Company, Detroit, plans extensions in underground cable lines to cost $3,000,000. The Consumers Power Company, Jackson, Mich., plans a 140,000-volt transmission line from the Saginaw River power plant to Flint, Mich., and the reconstruction of the present line to Muskegon, Mich., to cost $750,000. The Hopper Paper Company, Taylorville, Ill., plans a mill addition to cost $1,000,000. The Mary Ann Baking Company, Chicago, plans a baking plant to cost $85,000. Ronneberg & Pierce, 10 South LaSalle Street, Chicago, architects, are drawing plans for a local chemical factory to cost $150,000. The C. A. Burnette Company, Chicago, will build an addition to its meat-packing plant to cost $85,000. Chicago, Ill., plans a technical and trade high school to cost $3,000,000. The Olson Rug Company, Chicago, plans an addition to cost $1,000,000. Richmond, Ind., plans extensions in the municipal power plant to cost $300,000. The Indianapolis Power & Light Company, Indianapolis, Ind., plans a superpower steam-operated electric generating plant on the White River, to cost $5,000,000. The Hupp Motor Corporation, Detroit, plans an expansion at the branch plant at Cleveland, Ohio, to cost $1,000,000. The Church Budget Envelope Company, Salem, Ohio, plans an addition to cost $75,000. Oak Harbor, Ohio, plans a municipal power plant. The Aeronautical Corporation of America, Cincinnati, Ohio, is asking bids until March 1 for an aircraft plant to cost $100,000. The Ohio Power Company, Newark, Ohio, will make extensions in transmission lines in the Wellsville and East Liverpool districts to cost $25,000. Lakefield, Minn., plans to install additional equipment in its municipal lighting plant. Duluth, Minn., will soon take bids for a traffic light signal system. Brownsdale, Minn., plans a municipal light and power distributing system. The Pioneer Gravel Equipment Company, Minneapolis, Minn., will build an addition to cost $70,000. The Iowa Public Service Company, Sioux City, Iowa, plans a transmission line from Rockwell City to Pomeroy, Iowa, to cost $50,000. East Liverpool, Ohio, St. Paul, Minn., and Leon, Iowa, plan ornamental lighting systems. The Municipal Utilities Company, Des Moines, Iowa, plans an electric light and power plant at Clarion, Iowa, to cost $150,000, and a similar plant is contemplated at Sumner, Iowa.

Industrial Equipment Sales Outstanding in New England

Heavy driving machinery for textile mills and paper mills has been ordered recently in the New England district. Electric furnaces for heat treating are receiving much attention and small motors are selling at a brisk rate. New construction material orders are beginning to increase in volume. Steady activity in equipment for various industries is outstanding at the present in this district. New loom machinery and many changes in a number of plants have reflected a number of interesting orders for driving motors and control. Orders for special switch and control equipment recorded were encouraging and show gains in buying interest. Several electric furnaces, including two 40-kw. and one 60-kw. units, were recently ordered. Small motor sales are brisk and totaled over $60,000 for the past week and orders for fractional-horsepower motors are being received in good volume. Construction projects are as follows:

The Truscon Steel Company, Youngstown, Ohio, will erect a fabricating plant in Boston. Plans are afoot for a second transmission line between the Turners Falls, Mass., plant of the Western Massachusetts system and Pittsfield, Mass. The Edison Electric Illuminating Company, Boston, plans a steam-operated electric power plant on the Mystic River, Everett, Mass., to cost $500,000. The Worcester Polytechnic Institute, Worcester, Mass., plans a mechanical engineering laboratory to cost $300,000. The Blanchard Machine Company, Cambridge, Mass., plans an addition to cost $75,000. The United Illuminating Company, Bridgeport, Conn., plans a service building and a power addition to its generating plant to cost $400,000.

Purchasing Less Active in Southeast

A slowing up in purchases but continued activity among pending projects is reported for the Southeast. Central-station orders were small in size and numbers, but very satisfactory inquiries for oil circuit breakers, condensers, power transformers, etc., are being received. One recent central-station order was for 2,150 50,000-volt pin type insulators, while another company ordered arrester equipment amounting to $3,200.

A new cotton bag mill in Alabama ordered industrial motor and switchboard equipment aggregating $80,000 and a new rayon plant in Georgia purchased electrical construction materials amounting to $30,000. Wiring materials totaling $15,000 will be required in connection with a large store building addition in Atlanta and orders are expected to be let within the next few weeks. Engineering and construction contracts have been let on a new hosiery mill in Tennessee and this plant will cost $500,000. Equipment contracts on this job will be let within the next 30 days. There is some activity to be noted in plans for rehabilitations for small independent electric systems, one jobber having received six orders from municipalities for poles, the orders averaging $600 to $800 each. One of the larger municipal systems in North Georgia ordered distribution transformer equipment amounting to $1,500. Construction projects are as follows:

Louisville, Ky., plans an ornamenal lighting system. Russellville, Ky., plans a flood lighting system and beacon lamps at its proposed municipal airport. The Plough Chemical Company, Memphis, Tenn., plans an addition to cost $700,000. Nashville, Tenn., is planning the appropriation of $50,000, for extensions and improvements in its street lighting system. The Union Bleachery, Greenville, S. C., plans a mill to cost $260,000. The Alabama Coca-Cola Bottling Company, Anniston, Ala., plans a plant to cost $100,000. The Agnes Scott College, Decatur, Ga., plans a power plant and mechanical laundry to cost $100,000. The Pepperell Manufacturing Company, Lindale, Ga., plans the installation of a turbine unit of about 6,000 kw. capacity and auxiliary equipment in its power plant.

Business Continues Brisk in Eastern District

Orders and inquiries continue at an encouraging rate in the Eastern district, with both central stations and industrial interests in the market. From present indications the first quarter of 1929 will be a record one in this district. A metropolitan power company has ordered turbine parts for renewal and repair to cost $50,000. A northern New York utility has given a contract for transformers and switchgear equipment costing $110,000, while a South Carolina power interest has placed an order for transformers to cost $75,000. The outlook for continuance of central-station account is excellent. The Philadelphia Electric Company has announced an expansion and betterment program to cost $22,000,000, a considerable portion of the fund to be utilized for power substations and transmission lines. Another development of primary moment is the appropriation of the American Gas & Electric Company, totaling $11,000,000, for a hydro-electric generating station on the New River, near Radford, Va., for its subsidiary, the Appalachian Electric Power Company.

Industrial plants have been good purchasers of switchgear, motors, controls and kindred equipment. A rayon manufacturer in New Jersey has given an order to a New York maker for switchgear to cost $35,000, while an electrical contracting company in New York has placed a contract for similar apparatus costing $30,000. A manufacturer of washing machines in northern New York has given a commitment for a quantity of fractional-horsepower motors amounting to $60,000, while a firearms company in the same vicinity has contracted for similar units to a sum of $20,000. A metropolitan contractor has purchased a number of general purpose motors to cost $20,000. Oil burner and electric refrigerator manufacturers are prominent in the market for motor requirements. An industrial interest in Connecticut has ordered a quantity of dynamometers to cost $30,000.

Control apparatus is finding a ready market, with paper companies a leading factor. A New York corporation, operating paper mills in Canada, has purchased four paper mill drives, with controls and accessories, amounting to $225,000. A metropolitan daily has contracted for electric drives for presses, with complete control equipment costing $60,000, and for press reels and accessories to an amount of $140,000. Wire and cable account shows a tendency to higher levels and inquiries are strong. A metropolitan power company has placed an order totaling $800,000 for high-voltage, oil-filled cable lines

for underground transmission service. Construction projects are as follows:

P. R. Mallory & Company, Port Chester, N. Y., will establish a plant at Indianapolis, Ind., for the production of special metal alloys, to cost $200,000. The Ford & Kendig Company, Philadelphia, plans a pipe-fitting and mill supply manufacturing plant to cost $500,000. Scranton, Pa., is asking bids until March 11 for a technical and vocational high school addition to cost $515,000. The Standard Sanitary Manufacturing Company, Pittsburgh, plans a plumbing equipment manufacturing plant at Birmingham, Ala., to cost $250,000. The Hazel-Atlas Glass Company, Washington, Pa., will build an addition to cost $150,000. The Bureau of Supplies and Accounts, Navy Department, Washington, will receive bids until March 5 for insulated wire and cable for eastern and western yards (Schedule 464). The Department of Commerce, Washington, will receive bids until March 5 for electric revolving beacons, etc., for the Salt Lake City-Pasco airway (Proposal 20540.)

Activities of the Trade

Consolidation of Electric Firms Approved

The consolidation of the Square D Company of Detroit and the Industrial Controller Company of Milwaukee, the two major units in the manufacture of electric switches, panelboards and other electrical control devices, has been approved by the two companies. According to present plans T. J. Kauffman is to head the consolidated company as president, Carlton M. Higbie, F. W. Magin and L. W. Mercer will be vice-presidents and W. S. Worcester secretary and treasurer. Both companies are constructing additions to their properties to facilitate the handling of business.

Kelvinator Distributors Hold Conventions

More than 4,000 Kelvinator distributors and dealers are attending regional conventions in 21 cities during this month and are looking forward to the biggest year they have ever enjoyed.

"At no other time in the history of the industry," said George W. Mason, president and general manager of Kelvinator, "has the outlook held such promise of success, for manufacturer and retailer alike. Electric refrigeration has inevitably attracted men of that caliber and character so necessary to outstanding achievement in any great enterprise today. From an experiment and novelty in a handful of homes a few short years ago, it has grown in efficiency and use with such amazing rapidity and yet grown on so sound and substantial a foundation that today the electric refrigerator is accepted all over the civilized world as a standard piece of home equipment."

Kelvinator's development of silent operation is regarded as an important forward step. Commercial units for 1929 stress greater flexibility. The new Kelvinator commercial equipment, though decreased in the number of units, has increased its range of applications. Six new condensing units were shown at the various conventions giving completely graduated coverage, also three new cooling units of the incomparable cross-fin type.

General Cable Opens Plant in Mobile, Ala.

The General Cable Corporation announces the opening of the Mobile, Ala., plant of its Southern States Cable Company division. The plant will draw and strand copper wire and also will manufacture the "OK" brand of weatherproof wire. A large part of the plant will be devoted to a complete warehouse stock of all kinds of insulated wires and cables. The building is 540 ft. long and 120 ft. wide, giving a total floor area of 74,000 sq.ft. Harry Parker has been appointed manager and secretary of the Southern States Cable Company. R. M. Roberts is assistant treasurer and is in charge of sales work at the mill and H. P. Hitchcock has been appointed auditor. The new plant will be operated as a separate organization and will have its own direct sales representatives in Charlotte, Atlanta, Birmingham and Dallas.

Edison Lamp Works Show 51 per Cent Sales Increase

The "Six-Shooter" contest which featured the nation-wide sales activity on Edison "Mazda" lamps was recently brought to a close when the Edison Lamp Works of the General Electric Company awarded $8,000 in cash prizes to 207 contest winners. During the contest period, which extended from September 1 to October 31 last, active participants gained an increase in lamp sales of 51 per cent over the corresponding period of 1927. The first prize was awarded to Louis G. Elfers of Muscatine, Iowa, the prize amounting to $500. First prize for central stations, carrying with it an award of equal size, was won by W. B. Harris of the Knoxville Power & Light Company, Knoxville, Tenn.

Unique methods were used in promoting the sales campaign and many new ideas proved of great value. Sellers resorted to radio, exclusive motion-picture films and special sales meetings to arouse enthusiasm.

Reports submitted by contestants showed that during the campaign 75 per cent of all lamp sales were carton sales.

Copeland Products Holds Annual Convention

Silent operation was the feature of the new electric refrigeration line of the Copeland Products, Inc., which was viewed by the distributors and dealers for the first time at their convention held in Detroit February 5 and 6, attended by more than 400 distributors and dealers from all over the United States and Canada.

William Robert Wilson, chairman of the board of directors, stated that Copeland would show what he characterized as a "moderate" profit for 1928 and which would place Copeland well to the front of the electric refrigeration industry. He set from 25 to 50 per cent as an estimate of increase for 1929 and hinted at an extensive program of expansion in the near future.

W. D. McElhinny, vice-president in charge of sales and in general charge of the convention, exhibited the new line, vividly demonstrating the quiet operation feature.

Graybar, Western Electric, Bell Telephone Conference

The executives, engineers and house specialists connected with the electrical research work of the Graybar and Western Electric companies and the Bell Telephone Laboratories concluded a week's conference at the Graybar headquarters, 420 Lexington Avenue, New York City, on the scientific developments relative to radio broadcasting, public address and telephone systems, power line carriers and mechanical aids for hearing.

CUTLER-HAMMER, INC., Milwaukee, announces that it has acquired the business of the Trumbull Vanderpoel Electric Manufacturing Company of Bantam, Conn., which will be operated as a subsidiary under its present name. This adds a complete line of meter service and safety switches to the present Cutler-Hammer line of motor control, wiring devices and allied electrical devices.

COPELAND PRODUCTS, INC., Detroit, manufacturer of electric refrigerators, announces that orders on hand for immediate shipment are four times those at any similar time in the company's history, according to W. D. McElhinny, vice-president in charge of sales.

THE WESTINGHOUSE ELECTRIC INTERNATIONAL COMPANY plans to have the future sale in France of Westinghouse Electric products conducted by the Westinghouse Electric Company of France, which has been organized under the laws of the state of Delaware. No

manufacturing facilities in France are contemplated by the newly organized company. The officers and directors have not yet been elected.

THE EAGLE ELECTRIC MANUFACTURING COMPANY, 59 Hall Street, Brooklyn, N. Y., manufacturer of electrical specialities, announces that, due to the steady increase in business, it has been necessary to acquire an additional plant space of 5,000 sq.ft., bringing its total to 35,000 sq.ft. of working space.

THE SPLITDORF-BETHLEHEM ELECTRICAL COMPANY, Newark, N. J., has made Charles Edison president, and the new board of directors consists of Ralph H. Allen, George de K. Gilder, Ernest J. Howe, Henry Lanahan, William M. Lybrand, Harry F. Miller, John V. Miller, William W. Nichols, Eugene C. Reed and Joseph Wilson.

STRUTHERS DUNN, INC., announces that Norman McKinney, who served as sales manager for the Signal Engineering Company, has joined J. Struthers Dunn of Philadelphia, manufacturer of "Dunco" products, specializing in relays, thermostats and signal equipment under the name of Struthers Dunn, Inc.

THE WESTERN ELECTRIC COMPANY has leased approximately 50,000 sq.ft. of floor space in the Colgate warehouses for the manufacture of machinery that will be used in its Baltimore plant.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY, 128 South Sangamon Street, Chicago, announces the appointment of Westerman McCouch to help out Mr. Colvin in the Philadelphia territory. John Kramer has been placed in charge of the Kansas City, Mo., territory as panelboard specialist.

THE DESPATCH OVEN COMPANY, Minneapolis, announces that Herbert C. Beik, 21 East 40th Street, New York City, has been appointed district engineer and sales representative in the eastern part of the state of New York, Long Island, the northern part of New Jersey, and also Connecticut, Rhode Island, Massachusetts, New Hampshire and Maine.

THE SANGAMO ELECTRIC COMPANY, Springfield, Ill., manufacturer of electric meters, etc., has removed its New York office from the Hudson Terminal Building to the Chanin Building, 122 East 42d Street. Reginald M. Campbell, Eastern district manager, advises that its service station also will be moved to 228 East 45th Street.

THE ELECTRIC AUTO-LITE COMPANY, Toledo, Ohio, has purchased the electric storage battery division of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa. The capacity of the newly acquired plant is being increased from 300 batteries a day to 1,000. The company is said to be planning for 1929 a production of 8,000,000 batteries, which will represent nearly 50 per cent of the entire electric battery output of the entire industry.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has organized an electric refrigeration department with headquarters at the Mansfield, Ohio, works. J. S. Tritle has been appointed general manager of the new department and Carl D. Taylor, formerly manager of the industrial division of the company's Pittsburgh office, has been appointed manager of the refrigeration department by Mr. Tritle.

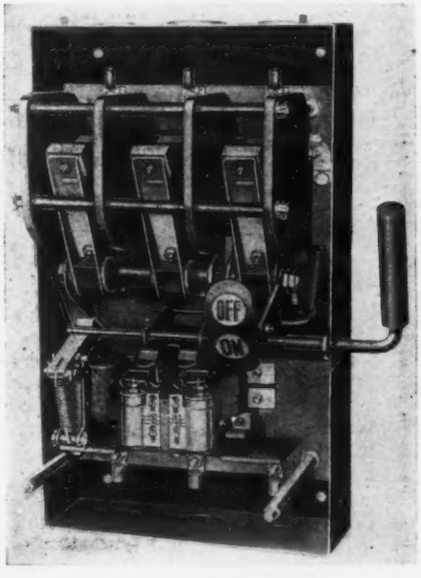
THE ALLIS-CHALMERS MANUFACTURING COMPANY, Milwaukee, has received a contract from the Calumet & Arizona Mining Company for a large double drum electric hoist. This hoist, which is for the company's Campbell shaft at Warren, Ariz., will be one of the largest in the Southwest and will incorporate the latest control devices and safety features so far developed in the art for a hoist of this type.

THE MARING WIRE COMPANY, Muskegon, Mich., manufacturer of magnet wire, announces that it is adding approximately 30,000 sq.ft. of manufacturing space to its factory, making a total of 80,000 sq.ft. The addition is designed to house equipment necessary to take care of commitments on fine enameled wires and will increase the annual production by 5,000,000 lb. of copper.

New Equipment Available

New Air Brake Circuit Breakers

The Roller-Smith Company of New York City announces a new line of small inclosed air brake circuit breakers, type E.A.F. These circuit breakers are offered for the protection of motors



and feeder circuits against overload and failures of voltage. They incorporate many new and novel features. Five features in particular stand out as characteristics: All type E.A.F. circuit breakers are free handle; operation is simple; there are barriers between poles; arc chutes; overload coils can be replaced with new coils of the same capacity or any other listed capacity by the man on the job; the new direct-acting time limit resets itself instantly after the breaker opens. Other details of interest are: All parts are in plain sight and easy to get at; there is plenty of space at top and bottom; knockouts are provided at top, bottom and sides; box can be installed when "roughing in" and breakers can be installed later. These breakers are made in capacities from ½ amp. to 80 amp., 250 volts d.c. and 550 volts a.c.; two and three pole.

Domestic Cooling Systems

A new automatic refrigerating unit for cooling rooms has been developed by the Frigidaire Corporation of Dayton, Ohio. The cooler draws air in through louvres in the bottom of the front panel and through the bottom of the cabinet. The air is passed over cooling coils located in the bottom half of the cabinet and distributed by fans. In factory tests the cooler has lowered the temperature of an average-sized room as much as 10 deg. in 30 minutes. The humidity was also lessened by approximately 10 per cent. The cooler is so constructed that the fan may be used alone in the manner of an ordinary electric fan.

The cooler cabinet is 48¾ in. high and weighs 210 lb. The fans are set at an angle which propels the cooled air to a height of about 7 ft. and thus only the air in the lower 7 ft. of the room is cooled. It is equipped with an automatic temperature control which may be adjusted by the owner so that the temperature will not go below that desired for maximum comfort.

The new cooler is completely equipped with compressors. It is only necessary to plug into the electric socket for immediate operation.

Compensators for Use in Dangerous Atmospheres

A device bearing the designation CR-1034-M-52 to meet the need for hand-starting compensators for use in places where there are explosive gases or gasoline fumes is announced by the General Electric Company. The new device is a modification of standard equipment so designed as to eliminate exposed arcing.

The starting switch in this device is

oil immersed. In addition the usual push-button tripping device is not included in the equipment, but instead standard time-delay undervoltage attachments and dashpot relays are used with Cooper-Hewitt mercury tubes substituted for the usual contact tips of the dashpot relays. As a result of this arrangement exposed sparking or arcing of contacts is eliminated. The new compensator is available for use with motors 25 to 60 cycles, two or three phase in sizes as follows: 15 hp. and less, 110 volts; 125 hp. and less, 220, 440 and 550 volts.

New Relay is Unusually Sensitive

An extremely sensitive relay for use in locations where either the length of lines or the number of devices on the line has caused sufficient voltage drop to render a standard relay inoperative has been developed by the Benjamin Electric Manufacturing Company of Chicago. It responds to exceptionally weak current impulses of alternating-current telephone ringing circuits in operating loud extension signals and is especially suitable and recommended for power transmission lines, oil pipe lines, mine shafts and all operations or locations requiring long communication systems.

This new relay consists of a polarized unit connected into the telephone ringing circuit and a delay relay with its secondary controlling a 110-volt signal circuit. The delay relay bridges the gap between cycles of the alternating-current ringing current, but responds to the longer intervals between the code signaling impulses. Because of the high impedance of the coils the relay can be used on lines having 1,000 to 2,500 ohm relays or ringers and will operate on a range of current from 8 to 135 volts, 16 to 30 cycles. Contact capacity is 1 amp. at 110 volts, or 110 watts at other voltages. The battery circuit requires 6 volts and 2 amp.

Electrical Patents

Announced by U. S. Patent Office

(Issued February 5, 1929)

1,700,950. ALARM SIGNAL SYSTEM; W. Pijakowski, Chicago, Ill. App. filed Sept. 19, 1925.

1,700,983. CONDUIT ELBOW; J. W. Hooley, Larchmont, N. Y. App. filed Sept. 17, 1927.

1,700,985. PROCESS AND DEVICE FOR JOINING, FINISHING, AND FINAL INSULATING WIRE TERMINALS OF ELECTRICAL CONDUCTORS; C. H. Jasper, Rotterdam, Netherlands. App. filed June 23, 1921.

1,701,012. ELECTRIC HOT AIR FURNACE; G. J. Rohn and A. Pfau, Jr., Milwaukee, Wis. App. filed Sept. 24, 1923.

1,701,051. ELECTRIC MOTOR; S. Neroni and E. Valoppi, Pittston, Pa. App. filed Jan. 17, 1927.

1,701,094. LONG-SPLICE CLAMP; R. A. Becker, Poughkeepsie, N. Y. App. filed April 19, 1927.

1,701,096. ELECTRIC AIR-HEATING RADIATOR; R. T. Bowling and H. L. Cobb, Fresno, Calif. App. filed Jan. 7, 1927.

1,701,104. RAIL BOND; H. H. Febrey, Newark, N. J. App. filed Jan. 23, 1924.

1,701,117. CANOPY CONDUIT-OUTLET BOX; J. T. Pearson and R. H. Olley, Syracuse, N. Y. App. filed Jan. 26, 1926.

1,701,119. MAGNETO-STARTER PAWL-TRIPPING DEVICE; L. J. M. Peterson, Newark, Ill. App. filed April 26, 1927.

1,701,156. INDUCTIVELY-HEATED DRYING DRUM; C. C. Heritage, Cornell, Wis. App. filed Feb. 10, 1927.

1,701,196. ELECTRIC-POTENTIAL DETECTOR; C. H. Spangler, Reading, Pa. App. filed Dec. 12, 1925.

1,701,215. CASING FOR ELECTRIC LAMP SOCKETS; A. C. Recker, Oakville, Conn. App. filed Sept. 4, 1926.

1,701,244. SUPPORT FOR VARIABLE CONDENSERS; C. Pfanstiehl, Highland Park, Ill. App. filed July 20, 1925.

1,701,251. AUTOMATIC HIGHWAY CROSSING SIGNAL MECHANISM; C. Adler, Jr., Baltimore, Md. App. filed Jan. 23, 1928.

1,701,278. HIGH-TENSION CABLE; S. Silbermann, Porz-on-the-Rhine, Germany. App. filed June 23, 1924.

1,701,279. END SLEEVE AND JUNCTION BOX FOR HIGH TENSION CABLES; S. Silbermann, Porz-on-the-Rhine, Germany. App. filed June 25, 1924.

1,701,331. CONSISTENCY METER; W. L. Merrill, Schenectady, N. Y. App. filed Aug. 26, 1925.

1,701,334. TRANSFORMER; K. K. Palueff, Pittsfield, Mass. App. filed April 18, 1928.

1,701,340. INTERNAL COMBUSTION ENGINE AND GENERATOR; H. F. Schmidt, Lansdowne, Pa. App. filed June 24, 1926.

1,701,342. FILAMENT FOR INCANDESCENT LAMPS AND THE LIKE; F. Skaupy, Berlin, Germany. App. filed April 20, 1925.

1,701,346. ELECTROLYTIC APPARATUS AND METHOD OF OPERATION; E. Thomson, Swampscott, Mass. App. filed March 25, 1926.

1,701,350. ELECTRIC SHIP PROPULSION; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Feb. 16, 1920.

1,701,351. AUTOMATIC RECLOSING CIRCUIT BREAKER SYSTEM; A. E. Anderson, Scotia, N. Y. App. filed April 28, 1926.

1,701,352. ELECTRIC SWITCH; A. E. Bailey, Jr., Schenectady, N. Y. App. filed Dec. 10, 1926.

1,701,357. CIRCUIT-CONTROLLING DEVICE; H. E. Butler, Schenectady, N. Y. App. filed Feb. 1, 1924.

1,701,358. ELECTRIC MEASURING APPARATUS; C. Camilli and A. Boyajian, Pittsfield, Mass. App. filed Dec. 8, 1926.

1,701,362. DYNAMO-ELECTRIC MACHINE; C. H. Haddrell, Swampscott, Mass. App. filed Aug. 8, 1927.

1,701,364. DIESEL-GENERATOR COMBINATION; H. T. Herr, Merion, Pa. App. filed March 1, 1927.

1,701,365. POWER PLANT INSTALLATION; H. T. Herr, Merion, Pa. App. filed March 31, 1927.

1,701,369. CONTROL OF ELECTRIC POWER; E. L. Hough, Schenectady, N. Y. App. filed Oct. 16, 1926.

1,701,370. CONTROL APPARATUS; E. L. Hough, Schenectady, N. Y. App. filed Oct. 16, 1926.

1,701,371. SCAVENGE-AIR APPARATUS; H. T. Herr, Merion, and A. T. Kasley, Moores, Pa. App. filed March 31, 1927.

1,701,372. ARC WELDING; F. M. Jefts, Scotia, N. Y. App. filed Nov. 23, 1927.

1,701,373. ELECTRIC SHIP PROPULSION SYSTEM; D. E. Jewitt, Rugby, England. App. filed Sept. 8, 1924.

1,701,379. PROTECTIVE ARRANGEMENT; J. S. Lennox, Pittsfield, Mass. App. filed June 4, 1928.

1,701,382. ELECTRIC SHIP PROPULSION; C. Macmillan, Schenectady, N. Y. App. filed March 21, 1924.

1,701,386. RESISTANCE; G. J. Mucher, Troy, N. Y. App. filed Nov. 30, 1927.

1,701,387. TERMINAL CONNECTER; H. Rabezzana, Flint, Mich. App. filed May 6, 1925.

1,701,388. METHOD OF AND APPARATUS FOR SEALING-IN INCANDESCENT LAMPS AND SIMILAR ARTICLES; H. Remané, Winterthur, Switzerland. App. filed April 7, 1925.

1,701,398. PERIODIC SWITCHING MECHANISM; H. W. Vickery, Lynn, Mass. App. filed Feb. 20, 1924.

1,701,399. ADJUSTABLE SWITCHING MECHANISM; H. W. Vickery, Lynn, Mass. App. filed March 19, 1925.

1,701,408. ELECTRIC SWITCH; H. C. Heath, Wembley, E. D. Regis, Stonebridge Park, and H. G. Ruddick, Acton, England. App. filed Dec. 26, 1925.

1,701,440. SWITCH-LATCHING MECHANISM; H. M. Chatto, Schenectady, N. Y. App. filed July 1, 1925.

1,701,468. MOTOR PROTECTOR; A. Arutunoff, Los Angeles, Calif. App. filed April 15, 1927.

1,701,476. SAFETY SOCKET; J. G. Miller, Omaha, Neb. App. filed May 16, 1927.

1,701,481. CONTROL OF ARC LIGHTS FOR PROJECTORS; T. Hall, Brooklyn, N. Y. App. filed June 29, 1921.

New Trade Literature

ELECTRICAL APPLIANCES.—A catalog issued by the Fitzgerald Manufacturing Company, Torrington, Conn., describes and illustrates the "Star-Rite" modern electrical appliances, including waffle irons, toasters, heating pads, kitchenette plates, health appliances, fans, etc., also the new "Star-Rite" electric ranges in both cabinet and apartment styles.

SWITCHES, PLUGS AND RECEPTACLES AND CONNECTORS.—The Bryant Electric Company, Bridgeport, Conn., is distributing pamphlets covering its flush tumbler switches, known as the Bryant No. 3951 series, the Bryant "KoNox" line of plugs and receptacles and the Bryant solderless wire connectors.

OIL CIRCUIT BREAKERS AND ARRESTERS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued circulars No. 1804 and No. 1812 which describe and illustrate respectively its types 0-31 and 0-441 electrically operated oil circuit breakers for indoor and outdoor service and its types G-22 and G-222 electrically operated oil circuit breakers for indoor or outdoor use. The company also is distributing leaflet No. 20,149-E covering its type SV autovalve lightning arresters for station use on alternating-current light and power circuits from 1,000 to 220,000 volts.

INSULATING MATERIALS.—A bulletin containing prices of its insulating materials has been issued by the Mitchell-Rand Manufacturing Company, 18 Vesey Street, New York City.

INDICATOR. — The Federal Products Corporation, Providence, R. I., is distributing pamphlets covering its model "80" Junior dial indicator and its universal dial indicator set No. 740.

SKIP HOISTS.—The Stephens-Adamson Manufacturing Company, Aurora, Ill., has issued a booklet covering the S-A skip hoist designed primarily to elevate bulk materials. The booklet contains line drawings and illustrations of typical installations of the S-A skip hoists.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Berlin, Germany (No. 36,241), for electrodental equipment.

An agency is desired in Danzig, Germany (No. 36,243), for electrodental equipment.

Purchase is desired in Addis Ababa, Ethiopia (No. 36,292), of low priced flash lights.

Purchase and agency are desired in Vienna, Austria (No. 36,153) for insulating materials, except porcelain.

Purchase and agency are desired in Budapest, Hungary (No. 36,175), for farm lighting plants.

A sole agency is desired in Sydney, Australia (No. 36,168), for electric paint-spraying equipment for garages.

Purchase and agency are desired in The Hague, Netherlands (No. 36,232), for electric refrigerators, refrigerating systems and units.

Purchase is desired in Belgrade, Yugoslavia (No. 36,293), of underground telephone cables.

Purchase is desired in Quebec, Canada (No. 36,302), of wiring supplies and fixtures.